Re-Accredited 'B++' 2.86 CGPA by NAAC
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વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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–: પરિપત્ર :–

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન અનુસ્નાતક અભ્યાસક્રમ ચલાવતી તમામ કોલેજોનાં આચાર્યશ્રીઓ તથા વિભાગીય વડાશ્રીને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪ થી અમલમાં આવનાર M.Sc.Sem. 4 ના Pharmaceutical Chemistry, Organic Chemistry, Physical Chemistry, Enviornmental Chemistry અને Analytical Chemistry ના અભ્યાસક્રમ સંદર્ભે રસાયણશાસ્ત્ર વિષયની અભ્યાસ સમિતિની તા.૦૪/૧૨/૨૦૨૩ની સભાના ઠરાવ ક્રમાંક :૦૫ અન્વયે નીચે મુજબ કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૦૬/૧૨/૨૦૨૩ની સભાનાં ઠરાવ ક્રમાંકઃ ૪૬ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

રસાયણશાસ્ત્ર વિષયનીઅભ્યાસ સમિતિની તા.૦૪/૧૨/૨૦૨૩ ની સભાનાં ઠરાવ ક્રમાંકઃ૦૫

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪ થી અમલમાં આવનાર M.Sc.Chemistry Sem.-4 નો Pharmaceutical Chemistry, Organic Chemistry, Physical Chemistry, Enviornmental Chemistry અને Analytical Chemistry નો અભ્યાસક્રમ સર્વાનુમતે મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૦૬/૧૨/૨૦૨૩ની સભાનાં ઠરાવ ક્રમાંકઃ ૪૬

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪થી અમલમાં આવનાર M.Sc. Chemistry Sem.-4 ના Pharmaceutical Chemistry, Organic Chemistry, Physical Chemistry, Enviornmental Chemistry અને Analytical Chemistry ના અભ્યાસક્રમ સંદર્ભે રસાયણશાસ્ત્ર વિષયની અભ્યાસ સમિતિની તા.૦૪/૧૨/૨૦૨૩ ની સભાના ઠરાવ ક્રમાંક :૦૫ અન્વયે કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિદ્યાશાખા વતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી મંજૂર કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંક : એસ./સાયન્સ/પરિપત્ર/૩૦૫૧૯/૨૦૨૩
તા.૦૭–૧૨–૨૦૨૩

કુલસચિવ

પ્રતિ,
૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ તથા વિભાગીય વડાશ્રી.
..... આપશ્રીની કોલેજ/વિભાગના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

એકેડેમિક કાઉન્સિલ તા. 06-12-2023
બાબત 46 બિડાણ/પરિશિષ્ટ 3.1

Veer Narmad South Gujarat University, Surat.

M. Sc. Chemistry Programme

Syllabus
M.Sc. Pharmaceutical Chemistry
Semester-IV

To Be Effective From November-2023
NEP 2020

Name of Program	**Master of Science(Chemistry)**
Abbreviation	**M.Sc.**
Duration	**2 Years**
Eligibility Criteria	**Course- M. Sc. Pharmaceutical Chemistry** ELIGIBILITY: Graduation in Science with Chemistry or any subject equivalent to or allied to Chemistry.
Objective of the Course	The core objective of the M. Sc. Pharmaceutical Chemistry course is to prepare the students for dynamic career in industry and academia by providing an excellent environment of teaching and research in the core and emerging areas of the discipline.
Course Outcome	1. Students will have a solid theoretical foundation as well as the requisite abilities in pharmaceutical sciences, as well as the capacity to use them in research and development. 2. Students will have a strong theoretical basis in pharmaceutical chemistry, as well as the necessary skills to use them in research and development. 3. Students who have been trained in analytical methods in drug and formulation development, new drug application, and quality assurance in all parts of drug research will be able to use what they have learned to produce new products that will help people. 4. Through creative teaching approaches that encourage students to self-learn and expand their knowledge, students will be equipped to thrive in pharmaceutical research as well as prosper in the pharmaceutical sector or academia. 5. Professional values, excellent research communication abilities, problem-solving prioritization, and the capacity to understand pharmaceutical concerns in a larger perspective will be instilled in students. 6. The ability to evaluate important aspects of the matter they have studied, weigh the pros and cons of the ideology they adhere to in the field of pharmaceutical chemistry.
Course Specific Outcomes	Students need to build up foundation in the fundamentals & application of current chemical and scientific theories in the concerned branches of Inorganic, Organic, Analytical, Physical, Environmental and Pharmaceutical Chemistry. 1. Graduates will be able to exhibit pharmaceutical quality assurance expertise. As well as recognize, formulate, and solve quality problems in the pharmaceutical business. 2. Graduates will be able to assess and comprehend data from analytical studies in pharmaceutical manufacturing, quality control, and assurance, as well as address regulatory difficulties in formulation design while satisfying pharmaceutical industry expectations and standards. 3. Graduates will be able to create validation protocols for all pharmaceutical processes, from drug discovery through formulation as well as analyse and solve issues using current pharmaceutical techniques, software, and equipment.

M. B. Mahida

	4. Graduates will be able to analyse and understand the results of analytical studies in pharmaceutical manufacturing, quality control, and assurance as well as solve regulatory concerns in formulation design in accordance with the pharmaceutical industry's demands and standards. 5. Graduates will be able to create validation protocols for all pharmaceutical processes, from drug discovery through formulation. 6. Graduates will be able to show that they are aware of their professional and ethical responsibilities under pharmaceutical legislation. 7. Graduates will have the confidence to study on their own and the capacity to learn for the rest of their lives. 8. Graduates will be able to explore chances for research and development in all areas of Pharmaceutical Quality Assurance, as well as work as part of a team and lead when necessary.
Medium of Instruction English	

Master of Science, Chemistry

M.Sc. Pharmaceutical Chemistry, Semester-IV

Theory Paper /Practical	**Teaching schedule Hrs/week**	**Exam Schedule**			**Total marks**	**Credit**
		Duration Hrs	Internal marks	External marks		
Theory papers:						
1) Core-1 (PhCC-401) D*rugs acting on central nervous system and antibiotics*	4	3	30	70	100	4
2) Core-2 (PhCC-402)*Pharmaceutical Organic Chemistry-II*	4	3	30	70	100	4
3) Core-3 (PhCC-403) *Hormonal And Pharmacokinetic Agents*	4	3	30	70	100	4
Inter/Multidisciplinary(AECC) 4) Elective Paper-1 (PhCE-401)*Chemotherapeutic Agents* **Or** Elective Paper- 2 (PhCE-401)*Physical health management and Natural products*	4	3	30	70	100	4
5) Skill Based Elective paper/Swayam/MOOC courses*	2	2	15	35	50	2
6) Practical	12	12	60	140	200	6
Total	30	26	195	455	650	24

***Common paper for all branches**

M. B. Mahida.

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology comprise classroom teaching, use of e-resources, library, IT tools, encourages students to participate in seminars/ workshops, presentations by students, assignments etc.

Evaluation Pattern		
No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	30%
3.	University Examination 2 Days, 6 h each days	70%

Master of Science, Chemistry

M.Sc. Pharmaceutical Chemistry, Semester-IV

NEP-2020

SYLLABUSTO BE EFFECTIVE FROM NOVEMBER-2023

Course Code- PhCC-401

PAPER-I: DRUGS ACTING ON CENTRAL NERVOUS SYSTEM AND ANTIBIOTICS

Total Credits of the Course	4	Hours per Week	4 hrs

Course Objectives:	• To understand antipyretic, analgesics and NSAIDs agents drugs. Opioid analgesics and its limitations. Their classification, Structure variations in Morphine and 4-Phenylpiperidine. Synthesis and uses of selected class of drug compounds with SAR. • To understand psychoactive drugs, study general anesthetics, local anesthetics and sedatives & hypnotics also their classification, structural variations and mode of action. • To understand types of anti-parkinsonian and anti-Alzheimer's agents, study their division, classification, general structure, effect of substituent, mechanism of MPTP, synthesis and acetylcholinesterase inhibitors • Introduction and classification of antibiotics including β-lactam antibiotics and non-classifiable antibiotics and learn about their medicinal importance, SAR and interfere with biosynthesis of bacterial cell walls.

M. B. Mahida

Unit	Description
1.	**ANTIPYRETIC, ANALGESICS AND NSAIDs AGENTS**(15 Periods) (A)Analgesics and Antipyretic: Origin and types of pain, introduction of analgesics, centrally acting and Peripherally acting agents, general classification of non-narcotic analgesics and antipyretic, SAR of Pyazolone derivatives, narcotic and opioid analgesics, general mode of action, receptors (name only), structure variations and SAR of Morphine. (B) Non-Steroidal Anti-Inflammatory agents: Mode of action, side effects, SAR of salicylates, 3,5-pyrazolodiones and Anthranilic acid, Drug used in treatment of gout (Zyloprim and Benemid) Synthesis and therapeutic uses of only the following: Meperidine (Pethidine), Ibuprofen, Oxyphenbutazone, Diclofenac Sodium, Mefanamic acid, Celecoxib.
2.	**PSYCHOACTIVE DRUGS**(15 Periods) (i) General Anesthetics: general classification, structural variations and mode of action (ii) Local Anesthetics: general classification and SAR, mode of action (iii) Sedatives and Hypnotics: general classification, structural variations among Barbiturates and diazepam, mode of action Synthesis and therapeutic uses of only the following: Thiopental (Pentothal), Amobarbital (Amytal), Clonazepam, Benzocaine, Procaine, Tetracaine (Anethaine).
3.	**ANTI-PARKINSONIAN AND ANTIALZHEIMER AGENTS**(15 Periods) Overview of neuromuscular disorder, introduction of Parkinson's disease, mechanism of MPTP, classification, pharmacotherapy of Parkinson's disease, dopamine receptor antagonist. Anti-Alzheimer's agents: Introduction,acetylcholinesterase inhibitors, MOA of acetylcholinesterase inhibitors, pathogenesis, medicinal importance of Tacrine HCl, Donepezil, Galantamine, Rivastigmine, Caprylidene Synthesis and therapeutic uses of only the following: Levodopa, Trihexyphenidyl HCl, Ethopropazine HCl, Biperiden HCl, Methocarbamol.
4.	**β-LACTAM ANTIBIOTICS**(15 Periods) General introduction and classification of antibiotics, broad spectrumantibiotics, antibiotics that interfere with biosynthesis of bacterial cell walls. (a) β-lactam antibiotics: Penicillins (Structural variations and SAR), Cephalosporins (Structural variations) (b) Non-classifiable antibiotics: medicinal importance/ clinical uses/ pharmacological applications of the following: Nalidixic acid, Norfloxacin, Ciprofloxacin. Synthesis and therapeutic uses of only the following: Methicillin, Ampicillin, Cephalexin, Fluoroquinolones.

M. B. Mahida

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	30%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand general classification of analgesic, antipyretic, NSAIDs Agents, general structure of each class of drugs with substituent, their SAR and trivial/generic name, synthesis and uses of selective drug.
2.	Understanding of CNS system, their classification and uses of selected class of drug compounds. Learn general classification of psychoactive agents, difference between sedative and hypnotics, general structure of each class of drugs with substituent, their SAR and trivial/generic name, synthesis and uses of selective drug.
3.	Understand about neuromuscular disorder, receptor antagonist. Learn about pathogenesis & name of related drugs and overview of different agents and inhibitors.
4.	Understand antibiotics, their classification, general structure, lactum, next generation antibiotics, structure variation, SAR, synthesis and uses of selected drug molecules.

Suggested References:

1. Burger's Medicinal Chemistry and Drug Discovery (5/e), 1997, Vol. 1, 2, 3, 4,5, Ed. ManFred E. Wolff (John Wiley & Sons, inc., New York).
2. Principles of Medicinal Chemistry, Vol. I & II (5/e), by S. S. Kadam, K. R. Mahadik, K. G. Bothra (Nirali Prakashan).
3. Principles of Medicinal Chemistry by William O. Foye (ed.), Lea and Febiyer, Philadelphia.
4. Wilson and Gisvold's Text-book of Organic Medicinal and Pharmaceutical Chemistry (5/e, 1982) by Robert F. Doerge (J. B. Lippincott Company, Philadelphia/Toppan Co. Ltd., Tokyo).
5. Essential of Medicinal Chemistry (2/e) by Andrejus Korolkovas (Wiley Interscience Pub., 1988, John Wiley & Sons, Canada).
6. Medicinal Chemistry by Ashutoshkar (Wiley Eastern Ltd., 1993).
7. The Pharmaceutical Basis of Therapeutics by Goodman and Gilman (The Macmillan Co.).
8. The Organic Chemistry of Drug Synthesis, Vol. I, II & III (1980), Ed. By D. Lednicer and L.

M. B. Mahida.

A. Mitscher (John Wiley and Sons, New York).
9. Topics in Medicinal Chemistry, Vol. I & II by Rabinowitz and Myerson (Editor) (Interscience, 1968).
10. Medicinal Chemistry, D. Sriram and P. Yogeeswari, 1st edi., Pearson Education, 2007.
11. Handbook of pharmaceutical chemicals by Dr. A. R. Shenoy and Dr. V. R. Shenoy Multitech Publishing Co., 15-Yogesh, Hingwala Lane, Ghatkopar (East) Mumbai.
12. Fundamentals of Medicinal Chemistry by G Thomas.
13. Textbook of Medicinal Chemistry, Volume I & II, Alagarsamy, 2010, Elsevier Publication.

On-line resources to be used if available as reference material

Master of Science, Chemistry

M.Sc. Pharmaceutical Chemistry, Semester-IV

NEP-2020

SYLLABUSTO BE EFFECTIVE FROM NOVEMBER-2023

Course Code- PhCC-402

PAPER-II: PHARMACEUTICAL ORGANIC CHEMISTRY-II

Total Credits of the Course	4	Hours per Week	4 hrs

Course Objectives:	• Study of Vitamins and Steroids, including biochemical functions of Vitamin A, Vitamins B_1 and B_2, Vitamin H and structure determination of Cholesterol and Ergosterol and biosynthesis of sterols. • To understand different kind of molecular rearrangement involving migration to electron deficient carbon, electron rich carbon, electron deficient nitrogen and aromatic rearrangements. • To provide basic theoretical understanding of heterocyclic chemistry, improving general methodology for different kind of ring synthesis which implies the new heterocyclic systems by changing the functionality with respective positions in skeleton. • To understand the concept of disconnection and combinatorial chemistry. Synthesis of drug molecules through disconnection approach, multi component reactions and parallel synthesis of drug molecules and their intermediates.

Unit	Description

M. B. Mahida.

1.	**VITAMINS AND STEROIDS**(15 Periods) (A)Vitamins: Deficiency, structure determination, synthesis and biochemical functions of Vitamin A, Vitamins B1 and B2, Vitamin H, Vitamin E. (B)Steroids: Introduction to sterols, structure determination of cholesterol and ergosterol, biosynthesis of sterols, bile acids: general introduction and structure.
2.	**MOLECULAR REARRANGEMENT** (15 Periods) (A)Rearrangement involving migration to electron deficient carbon: (i) Demjanov rearrangement (ii) Meyer schuster rearrangement (B)Rearrangement involving migration to electron rich carbon: (i) Favorskii rearrangement (ii) Neber rearrangement (C)Rearrangement involving migration to electron deficient nitrogen: (i) Stieglitz rearrangement (ii) Curtius rearrangement (D)Aromatic rearrangements: (i) Migration around the aromatic nucleus: Jacobsen rearrangement (ii) Migration of group from the side chain to the nucleus:Hoffmann-Martius rearrangement (E) Rearrangement involving migration from oxygen to ring: Claisen rearrangement
3.	**HETEROCYCLIC CHEMISTRY-2**(15 Periods) Synthesis, reactivity, aromatic character and importance of the following (a) Condensed five membered heterocycles: Benzopyrazole, Benzthiazole, Benzimidazole. (b) Condensed six membered heterocycles: Quinoline, Isoquinoline, Quinoxaline, Phthalazine. (c) Fused Heterocycles (Five and six membered with two heterocyclic ring): Medicinal approach, Purine, Pteridine, Naphthyridine.
4.	**SYNTHETIC STRATEGIES**(15 Periods) (A)Disconnection approach: Synthon, Synthetic equivalent, functional group interconversion, disconnection of olefines; β-hydroxy carbonyl compounds; α,β-unsaturated compounds and Diels-Alder based reaction. (B)Combinatorial Chemistry: Introduction, Combinatorial synthesis for Drug Optimization,Methods of parallel synthesis and Mixed Combinatorial Synthesis, linkers, Structure Determination and limitations, Examples of Combinatorial chemistry.

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology comprise classroom teaching, use of e-resources, library, IT tools, encourages students to participate in seminars/ workshops, presentations by students, assignments etc.

Evaluation Pattern

M. B. Mahida.

No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	30%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learnerwill be able to	
1.	To learn biochemical function of vitamins, classification & structural elucidation.To learn basic skeleton of steroids, structural elucidation of cholesterol, ergosterol, bile acids, their interrelation of each other and their physiological activities.
2.	To learn about type of rearrangement, migrating aptitude, ring expansion, contraction, strain theory, isotopic effect, effect of other groups with reference to functional group and their application.
3.	To learn about basic concept, synthesis and application of heterocyclic chemistry, aware about heterocyclic systems, types of heterocyclic rings, application of heterocycles in medicinal chemistry.
4.	To learn about disconnection approach and combinatorial chemistry. Application of combinatorial chemistry in drug synthesis including intermediates, parallel synthesis to get a class of drug molecule.

Suggested References:

1. Organic synthesis using transition metals-Roderick Bates (Wiley)
2. Organic chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford Press)
3. Some modern methods of organic synthesis – W. Carruthers (Cambridge)
4. Organic synthesis – Michael B. Smith
5. Advanced organic chemistry, Part B – F. A Carey and R. J. Sundberg, 5th ed. (2007)
6. Guidebook to organic synthesis-R K Meckie, D M Smith and R A Atken
7. Organic synthesis- Robert E Ireland
8. Heterocyclic Chemistry- J A Joule and Smith
9. Heterocyclic Chemistry-II- R R Gupta, M Kumar, V Gupta, Springer (India) pvt
10. Heterocyclic Chemistry, 4th Ed. by J. A. Joule & K. Mills, Pub. Chapman & Hall (1995)
11. Principles of modern heterocyclic chemistry, Edited by Leo A. Paquette, Pub. Pearson Benjamin Cummings (1968)
12. Heterocyclic Chemistry, 3rd Edition by Thomas L. Gilchrist, Publ.Prentice Hall (1997)
13. The Structure & Reactions of Heterocyclic Compounds, Edited by M. H. Palmer, Pub.Edward Arnold (1967)
14. Heterocyclic chemistry by V. K. Ahluwalia, Narosa publishing house.
15. Strategic Applications of named reactions in organic synthesis-Laszlo Kurti and Barbara Czako
16. Organic Synthesis, Jagdamba Singh & L.D.S. Yadav, 6th ed., Pragati Prakashan(2010).
17. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh (McMillan

M. B. Mahida.

India Ltd., 1976)
18. Advance Organic Chemistry, Reaction Mechanism and Structure by Jerry March, 4th ed. John Wiley & Sons.
19. An introduction to the chemistry of heterocyclic compounds-R M Acheso
20. Fundamentals of Medicinal Chemistry by G Thomas.
21.Foye's principle of medicinal chemistry, 5th edition by D. A. Williams and T. L. Lenke.
22. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry, 11th ed., John H. block, John M. Beale.
23. Chemistry of Vitamins – S. F. Dyke.
24. Natural Products Chemistry, Vol. I & II, K. Nakanishi.
25. The Molecules of Nature, J. B. Hendrickson.
26. Selected Organic Synthesis: Ian Fleming.
27. Chemistry of Natural Products, N. R. Krishnaswamy.
28. The Chemistry of Natural Products, K. W. Bentley. Vol. I – V
29. The Disconnection Approach by Stuart Warren

On-line resources to be used if available as reference material

Master of Science, Chemistry

M.Sc. Pharmaceutical Chemistry, Semester-IV

NEP-2020

SYLLABUSTO BE EFFECTIVE FROM NOVEMBER-2023

Course Code- PhCC-403

PAPER-III: HORMONAL AND PHARMACOKINETIC AGENTS

Total Credits of the Course	4	Hours per Week	4 hrs

Course Objectives:	• To understand hormonal drugs. SAR, Classification and MOA of given class of compounds and their synthesis. To learn Contraceptive agents, classification, MOA, synthetic and therapeutic usage. • To understand drugs acting on gastrointestinal tract and various Anti-Thyroid agents, learn about Anti-ulcerative and Anti-diarrheal drugs, classification Structural variations of gastric acid secretion inhibitors, SAR. • To understand drugs acting on respiratory tract, learn about Antitussive and Antiasthmatic agents including classification, therapeutic uses, mechanism of Action of Sympathomimetics. • To learn about types of anti-infective drugs and sulfonamides , their classification, general structures, effect of substituent, SAR, synthesis and uses.

M.B.Mahida.

Unit	Description
1.	**DRUGS IMPACTING HORMONAL SYSTEMS**(15 Periods) (I) Insulin and oral hypoglycemic agents (anti-diabetic agents or drugs affecting sugar metabolism): general classification, diabetic mellitus (Type I & II) and variants of Insulin. (II)Contraceptive agents: Introduction, classification, oral contraceptives, spermicides, mode of action, steroids as contraceptives. Synthesis and therapeutic uses of only the following:, Glybomuride, Chlorporpamide, Glipizide, Metformin, Norethindrone, Norgestrel.
2.	**DRUGS ACTING ON GASTROINTESTINAL TRACT & ANTI-THYROID AGENTS**(15 Periods) (I) Anti-ulcerative drugs: Introduction, Classification, Structural variations of gastric acid secretion inhibitors, SAR of H2-receptor Antagonists. Anti-diarrheal: Types of Anti- diarrheal agents, Anti- diarrheal interaction (II) Anti-Thyroid agents: Introduction, Classification, Mode of action, Problems related to Thyroid hormone. Synthesis and therapeutic uses of only the following: Cimetidine (Tagamet), Ranitidine (Zantac), Omeprazole (Omez), Rabeprazole, Carbimazole, Methimazole (Tapazele).
3.	**DRUGS ACTING ON RESPIRATORY TRACT**(15 Periods) General introduction and Classification of Antitussive, Respiratory stimulants Antiasthmatic agents:Classification, β2-Adrenergic agonists, Mechanism of Action of Sympathomimetics, Methylxanthines and Mast cell stabilizer; Structure variation in methylxanthines; SAR of sympathomimetics Synthesis and therapeutic uses of the following: Dextromethorphan HBr, Doxapram (Carbopram), Caffeine, Nikethamide (Coramine), Tiagabin, Adrenaline, Isoprenaline, Clidinium Bromide
4.	**LOCAL ANTI INFECTIVE DRUGS and SULFONAMIDES**(15 Periods) (a) Anti-mycobacterial agents: general introduction of Tuberculosis & Leprosy-disease, treatment, classification, mode of action, adverse effect of anti TB agents & anti-leprotic agents. (b) Sulfonamides, general classification, mode of action and SAR of Sulfonamides Synthesis and therapeutic uses of only the following: Ethionamide, Ethambutol, DDS (Dapsone), Pyrazinamide,Sulfamethoxine (Sufadoxine), Sulfamethoxy-Pyrazine (Sulfalene), Succinyl sulfathiazole (Sulfasuxidine), Nitrofurazone.

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology comprise classroom teaching, use of e-resources, library, IT tools encourages students to participate in seminars/ workshops, presentations by students, assignments etc.

M.B. Mahida.

Evaluation Pattern		
No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	30%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understanding of hormonal drugs, classification of anti-thyroid agents, hypoglycemic and hyperglycemic agents. Different types of diabetic mellitus and synthesis of given class of compounds. To learn Contraceptive agents, classification, MOA, synthetic and therapeutic usage.
2.	Learning about GI class of drug, their classification, synthesis and uses of the given drug molecules.SAR and MOA of GI class of drugs. SAR of receptor antagonist.
3.	Learning drugs acting on respiratory tract, Antitussive and Antiasthmatic agents including classification, therapeutic uses MOA of Sympathomimetics
4.	Learn general classification of anti-mycobacterial, anti TB agents and anti leprotic, their mode of action and synthesis of selected drug molecules. Learn general classification of sulphonamides, their structural variations, mode of action and synthesis of selected drug molecules.

Suggested References:

1. Burger's Medicinal Chemistry and Drug Discovery (5/e), 1997, Vol. 1-5, Ed. ManFred E. Wolff (John Wiley & Sons, inc., New York).
2. Principles of Medicinal Chemistry, Vol. I & II (5/e), by S. S. Kadam, K. R. Mahadik, K. G. Bothra (Nirali Prakashan).
3. Principles of Medicinal Chemistry by William O. Foye (ed.), Lea and Febiyer, Philadelphia.
4. Wilson and Gisvold's Text-book of Organic Medicinal and Pharmaceutical Chemistry (5/e, 1982) by Robert F. Doerge (J. B. Lippincott Company, Philadelphia/Toppan Co. Ltd., Tokyo).
5. Essential of Medicinal Chemistry (2/e) by Andrejus Korolkovas (A Wiley Interscience Publication, 1988, John Wiley & Sons, Canada).
6. Medicinal Chemistry by Ashutoshkar (Wiley Eastern Ltd., 1993).
7. The Pharmaceutical Basis of Therapeutics by Goodman and Gilman (The Macmillan Co.).
8. The Organic Chemistry of Drug Synthesis, Vol. I, II & III (1980), Ed. By D. Lednicer and L. A. Mitscher (John Wiley and Sons, New York).

M. B. Mahider.

9. Topics in Medicinal Chemistry, Vol. I & II by Rabinowitz and Myerson (Editor) (Interscience, 1968).
10. Adhunik Sanshleshit Aushodhonu Rasayanvighyan, Dr. Anamik Shah, University Granth Nirman Board, Ahmedabad.
11. Medicinal Chemistry, D. Sriram and P. Yogeeswari, 1st edi., Pearson Education, 2007.
12. Handbook of pharmaceutical chemicals by Dr. A. R. Shenoy and Dr. V. R. Shenoy Multitech Publishing Co., Mumbai.
13. Fundamentals of Medicinal Chemistry by G Thomas.
14. Textbook of Medicinal Chemistry, Volume I & II, Alagarsamy, 2010, Elsevier Publication.

On-line resources to be used if available as reference material

Master of Science, Chemistry

M.Sc. Pharmaceutical Chemistry, Semester-IV

NEP-2020

SYLLABUSTO BE EFFECTIVE FROM JUNE-2023

ELECTIVE PAPER -1

Course Code- PhCE-401

PAPER-IV: CHEMOTHERAPEUTIC AGENTS (ELECTIVE PAPER-1)

Total Credits of the Course	**4**	**Hours per Week**	**4 hrs**

Course Objectives:	• To understand anti-malarial drug, life cycle of plasmodium, general classification, their structural variation, synthesis and uses. • To understand cancer, types of cancer, drug molecule used as anti-cancer/ antineoplastic agents, their classification. Synthesis and use of given drug molecules. To understand types and treatment of depression. • To understand life cycle of virus. Various classes of enzymes, general structure of anti-viral and anti-HIV agents, structural variation, synthesis and uses. • To understand non-lactam antibiotics learn about Macrolide, medicinal importance, clinical uses, pharmacological applications.

Unit	Description
1.	**ANTIMALARIALS AND ANTIDEPRESSANTS**(15 Periods) (i) Antimalarials: Introduction, types, life cycle of plasmodium, drug resistance, general classification, SAR of 4- and 8-aminoquinolines and structure variation in Sesquiterpene Lactones, mode of action. Synthesis and therapeutic uses of only the following: Mefloquine,

M.B. Mahida

	Chloroquine, Primaquine, Pyrimethamine (Daraprim), Quinacrine. (ii)Antidepressants: Introduction, Types of depressive disorders, Classification of antidepressants, SAR of tricylic antidepressants (TCAs), mechanism of action, edverse effects; Selective 5- HT reuptake inhibitors, SAR of paroxetine, nontricyclic serotonin and norepinephrine reuptake inhibitors, Mood stabilizers. Synthesis and therapeutic uses of only the following: Amitriptyline HCl, Imipramine HCl, Isocarboxazide, Fluoxetine.
2.	**ANTINEOPLASTIC AGENTS (CANCER CHEMOTHERAPY)**(15 Periods) Introduction to cancer, types, causes & treatment of cancer, metastasis,carcinolytic antibiotics and mitotic inhibitors, drug resistance, targets of anticancer agents, adverse effects of cancer therapy (in brief) general classification of antineoplastic agents, Cell Cycle-Specific (CCS) and Non Cell Cycle-Specific agents, mode of action. Synthesis and therapeutic uses of only the following: Mechlorethamine, Cyclophosphamide, Melphalan, 6-Mercaptopyrine, Cytarabine, Chlorambucil.
3.	**ANTIVIRAL AGENTS**(15 Periods) Introduction, types & classes of viruses, classification of antiviral agents, mechanism of action, antiviral compounds for DNA viruses & selected RNA virus infections other than HIV (Influenza A and B Viruses, Hepatitis C Virus) Anti-HIV Drugs: Introduction, HIV infection and its pathological effects, HIV structure and life cycle, HIV drugs in clinical use, development of drug resistance. Synthesis and therapeutic uses of only the following: Amantadine, Acyclovir, Zidovudine, Indinavir, Nevirapine, Lamivudine.
4.	**NON-LACTAMANTIBIOTICS**(15 Periods) (a) Antibiotics that interfere with biosynthesis of bacterial cell walls. (b) Non-lactam antibiotics: Tetracycline (Structural variations and SAR) (c) Macrolide antibiotics, Amino glycoside antibiotics and (d) Non-lactam antibiotics: Medicinal importance/ clinical uses/ pharmacological applications of the following: Bacitracin, Vancomycin, Cycloserine, Erythromycin, Lincomycin, Chloramphenicol, Novobiocin. Synthesis and therapeutic uses of only the following: Chloramphenicol, Ciprofloxacin, Metronidazole, Cycloserine.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	30%

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2.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Learn life cycle of malaria, types of plasmodia, general structure of anti-malarial agents, structural variation among them, mode of action, synthesis and uses of selected drug molecules.
2.	To learn about cancer, types of cancer, classification of anti-cancer drugs, chemotherapy, synthesis and uses of specified antineoplastic agents.
3.	Understand life cycle of virus. Identification of enzymes responsible for replication of virus, mechanism of drug action. Synthesis and uses of selected drug molecules.
4.	Understand antibiotics, their classification, general structure, non-lactum antibiotics, next generation antibiotics, SAR, synthesis and uses of selected drug molecules.

Suggested References:

1. Burger's Medicinal Chemistry and Drug Discovery (5/e), 1997, Vol. 1-5, Ed. ManFred E. Wolff (John Wiley & Sons, inc., New York).
2. Principles of Medicinal Chemistry, Vol. I & II (5/e), by S. S. Kadam, K. R. Mahadik, K. G. Bothra (Nirali Prakashan).
3. Principles of Medicinal Chemistry by William O. Foye (ed.), Lea and Febiyer, Philadelphia.
4. Wilson and Gisvold's Text-book of Organic Medicinal and Pharmaceutical Chemistry (5/e, 1982) by Robert F. Doerge (J. B. Lippincott Company, Philadelphia/Toppan Co. Ltd., Tokyo).
5. Essential of Medicinal Chemistry (2/e) by Andrejus Korolkovas (A Wiley Interscience Publication, 1988, John Wiley & Sons, Canada).
6. Medicinal Chemistry by Ashutoshkar (Wiley Eastern Ltd., 1993).
7. The Pharmaceutical Basis of Therapeutics by Goodman and Gilman (The Macmillan Co.).
8. The Organic Chemistry of Drug Synthesis, Vol. I, II & III (1980), Ed. By D. Lednicer and L. A. Mitscher (John Wiley and Sons, New York).
9. Topics in Medicinal Chemistry, Vol. I & II by Rabinowitz and Myerson (Ed.) (Interscience, 1968).
10. Medicinal Chemistry, D. Sriram and P. Yogeeswari, 1st edi., Pearson Education, 2007.
11. Handbook of pharmaceutical chemicals by Dr. A. R. Shenoy and Dr. V. R. Shenoy Multitech Publishing Co., Mumbai.
12. Fundamentals of Medicinal Chemistry by G Thomas.
13. Textbook of Medicinal Chemistry, Vol. I & II, Alagarsamy, 2010, Elsevier.

M. B. Mahida.

On-line resources to be used if available as reference material

Master of Science, Chemistry
M.Sc. Pharmaceutical Chemistry, Semester-IV
NEP-2020
SYLLABUSTO BE EFFECTIVE FROM NOVEMBER-2023
ELECTIVE PAPER -2
Course Code- PhCE-402
PAPER-IV: PHYSICAL HEALTH MANAGEMENT AND NATURAL PRODUCTS(ELECTIVE PAPER-2)

Total Credits of the Course	4	Hours per Week	4 hrs

Course Objectives:	• To understand body energy needs in terms of various macro and micro nutrients, to learn importance of carbohydrates, fats, vitamins and minerals in human health. • To learn overweight and obesity, risk factors induced by obesity, various agents used in management of obesity and herbal remedies. • To understand drug used to advance human's health, male and female sex hormones, Menopause therapies and Testosterone replacement therapy. • To understand isolation and importance of flavonoids and terpenoids, their structural elucidation.

Unit	Description
1.	**NUTRITION**(15 Periods) Introduction, classification of nutrition, body energy needs Macronutrients: Carbohydrates, monosaccharide Absorption, Disaccharide metabolism, starch metabolism, glycogen synthesis and metabolism, classes of dietary fibers, non-nutritive sweeteners Fats and fatty acids: introduction, Health issue, substitution Micronutrients: Importance of Vitamins and minerals
2.	**OVERWEIGHT AND OBESITY**(15 Periods) Introduction, obesity-induced cardiovascular disease(CVD) and related risk factors, Pharmacotherapy of overweight & obesity Agents used in management of obesity (i)Sympathomimetic amines (ii) Serotonergic agents (iii) Miscellaneous class of anorexiants Over the counter drugs & Herbal remedies

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3.	**DRUG USED TO ADVANCE HUMAN'S HEALTH**(15 Periods) Drugs used in mediating women's fertility: Female sex hormone- Estrogens (Physiologicaleffects, SAR, clinical application and side effects), Progestine, Structure of synthetic Progestin (Class 1 to 5), Menopause therapies. Testosterone replacement therapy, Androgenic derivatives of natural and synthetic testosterone.
4.	**FLAVONOIDS AND TERPENOIDS**(15 Periods) **Flavonoids** Introduction, isolation and purification of flavonoids, General methods of structural determination of flavonoids, Structural elucidation of quercetin **Terpenoids** Classification, isolation, isoprene rule and general methods of structural elucidation of Terpenoids, Structural elucidation of drugs belonging to mono (citral, menthol, camphor), di(retinol, Phytol, taxol) and tri terpenoids (Squalene,Ginsenoside) carotinoids (β carotene)

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	30%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Learn body energy needs, classes of carbohydrates and dietary fibers, health issue related to excessive consuming of fat and fatty acids, general idea of vitamins and minerals.
2.	Learn about overweight and obesity, risk factors induced by obesity, various agents used in management of obesity and herbal remedies.
3.	Understand drug used to advance human's health, male and female sex hormones, Menopause therapies and Testosterone replacement therapy
4.	Understand isolation and importance of flavonoids and terpenoids, their structural elucidation.

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Suggested References:
1. Burger's Medicinal Chemistry and Drug Discovery (5/e), 1997, Vol. 1-5, Ed. ManFred E. Wolff (John Wiley & Sons, inc., New York).
2. Principles of Medicinal Chemistry, Vol. I & II (5/e), by S. S. Kadam, K. R. Mahadik, K. G. Bothra (Nirali Prakashan).
3. Principles of Medicinal Chemistry by William O. Foye (ed.), Lea and Febiyer, Philadelphia.
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5. Essential of Medicinal Chemistry (2/e) by Andrejus Korolkovas (A Wiley Interscience Publication, 1988, John Wiley & Sons, Canada).
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8. The Organic Chemistry of Drug Synthesis, Vol. I, II & III (1980), Ed. By D. Lednicer and L. A. Mitscher (John Wiley and Sons, New York).
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10. Medicinal Chemistry, D. Sriram and P. Yogeeswari, 1st edi., Pearson Education, 2007.
11. Handbook of pharmaceutical chemicals by Dr. A. R. Shenoy and Dr. V. R. Shenoy Multitech Publishing Co., Mumbai.
12. Fundamentals of Medicinal Chemistry by G Thomas.
13. Textbook of Medicinal Chemistry, Vol. I & II, Alagarsamy, 2010, Elsevier.

On-line resources to be used if available as reference material

Master of Science, Pharmaceutical Chemistry
NEP-2020
SYLLABUS TO BE EFFECTIVE FROM NOVEMBER-2023
Semester-IV
Course Code- PhP-401
PRACTICALS

Total Credits of the Course	**6**	**Hours per Week**	**12 hrs**

course Objectives:	• To impart basic knowledge for carrying out multistep synthesis based on some name reactions. • Understand nature of reaction and establishment of reaction condition with mechanism • To learn about the calculation of mole ratio for each reaction. • Able to interpret structure of important drugs from spectra like UV, IR, NMR and Mass. • Isolation of product, purification and confirmation of the product.

M. B. Mahida.

	• To understand the purpose of green synthesis.

Course Content

1	Preparation of compounds	4- Credit
2	Isolation	
3	Spectral Interpretation	4- Credit
4	Viva-Voce	

1. Preparation of drugs and drug intermediates by following: (any five)

i. Sulfanilamide from via p-acetamido benzene sulphonyl chloride and acetamido benzene-sulfonamide.
ii. Benzocaine from p-nitro toluene via p-nitro benzoic acid and p-amino benzoic acid.
iii. Anthrone from phthalic anhydride via o-benzoyl benzoic acid and anthraquinone.
iv. 4-Methyl-7-hydroxy-8-acetyl coumarin from resorcinol via 4-methyl-7-hydroxycoumarin and 4-methyl-7-acetyl coumarin.
v. Benzanilide from benzene via Benzophenone and Benzophenonoxime.
vi. 2-phenyl indole from acetophenone via acetophenone phenylhydrazone
vii. p-nitro chloro benzene from acetanilide via p-nitro acetanilide and p-nitroaniline.

2. Isolation of phytochemicals from their natural sources (any five)

1. Caffeine from Tea
2. Curcumin from turmeric
3. Lycopene from tomato
4. Caseine from milk
5. Citric acid from lemon
6. Peppermint oil extraction
7. Nicotine from tobacco

(TLC of extracted compounds)

Spectral Exercise (Minimum 10 from syllabus)

Structure interpretation of drugs and drug intermediates from spectra (UV, IR, NMR and Mass)

Teaching-Learning Methodology	Introduction, interaction with students in calculation of mole ratios, carry out experiments at each step according to the respective practical, interpretation of spectra and deduce the structure.

Evaluation Pattern		
No.	Details of the Evaluation	Weightage

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1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	30%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the basics to carry out reactions, nature of reaction and calculation of mole ratio.
2.	Establish mechanism and monitoring reaction at specified reaction condition.
3.	Learn to work-up after the completion of reaction, purification.
4.	Understanding of the compounds obtained by isolation process, their purification and confirmation of the structure.
5.	Understand the calculation with reference to respective factors.
6.	Learn to interpret structure of organic compounds from given spectra.
7.	Appreciate good laboratory practices.

Suggested References:

1. Vogel's Textbook of practical organic chemistry, 5th edition, B. S. Furniss, A. J. , P. W. G. Smith, A. R. Tatchell (Pearson Education).
2. Comprehensive practical organic chemistry: Preparation and Quantitative analysis, V. K. Ahluwalia, Renu Agarwal (Universities Press).
3. Monograph on Green Chemistry Laboratory Experiments by Green Chemistry Task Force Committee, DST
4. L. D. Field, S. Sternhell, J. R. Kalman - Organic Structures from Spectra-Wiley (2013)
5. Quantitative analysis by Arther I.Vogel
6. Quantitative analysis by V.K.Ahluwalia
7. Quantitative analysis by Mann and sanders

On-line resources to be used if available as reference material

M. B. Mahida.