

**VEER NARMAD SOUTH GUJARAT UNIVERSITY**  
**M.Sc. Semester-IV (ORGANIC CHEMISTRY)**  
**STRUCTURE OF THE SYLLABUS TO BE EFFECTIVE FROM JUNE 2019**

Sr. No.	Course Title	L	T/C/S	Credit
1	Advance Organic Chemistry	4	1	4
2	Selected Topics In Organic Chemistry-II	4	1	4
3	Advance Organic Synthesis	4	1	4
4	Medicinal Chemistry-II OR Dye and Intermediates-II	4	1	4
5	Practicals	12		8
		28	4	24

External Examination Time Duration: 03 hrs

Name of Exam	Semester	Paper No	Course group	Credit	Internal Marks	External Marks	Total Marks
M. Sc.	IV	I	Core	04	30	70	100
		II	Core	04	30	70	100
		III	Core	04	30	70	100
		IV	Core	04	30	70	100
			Practical	08	60	140	200
			Total	24	180	420	600



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**PAPER-I (Advance Organic Chemistry)**

**Max. Marks: 100 (External – 70 + Internal – 30)**

**Total  
Periods:45**

**UNIT-I NAME REACTIONS**

**(12 Periods)**

General nature, method, mechanism and synthetic applications of the following reactions;

- (1)Ugi reaction
- (2)Noyori reaction
- (3)Wittig reaction
- (4)Peterson olefination reaction
- (5)Mannich reaction
- (6)Stille reaction
- (7)Ene reaction
- (8)Staudinger reaction
- (9)Corey-Fuchs reaction
- (10)Ritter reaction
- (11)McMurry reaction
- (12)Michael addition

**UNIT-II OXIDATION**

**(11 Periods)**

Introduction, Oxidation with Cr(VI), Mn(VII), Mn(IV), OsO<sub>4</sub>, Periodic acid. Peroxy acid. Oxidation of hydrocarbons-alkenes, aromatic rings, saturated C-H group (activated and unactivated), aldehyde and ketones

**UNIT-III REDUCTION**

**(11 Periods)**

Introduction, different reductive processes, hydrocarbons-alkenes, alkynes and aromatic rings, Carbonyl compounds- aldehydes, ketones, (LiAlH<sub>4</sub>, NaBH<sub>4</sub> only for aldehyde and ketone) acids and their derivatives, epoxides, nitro, nitroso, azo and oxime groups, Birch reduction, Shapiro reduction.

**UNIT-IV MOLECULAR REARRANGEMENTS**

**(11Periods)**

**(A)Rearrangement involving migration to electron deficient carbon:**

- (i) Expansion and contraction of rings/Demajnov rearrangement
- (ii) Benzil-benzilic acid rearrangement

**(B)Rearrangement involving migration to electron rich carbon:**

- (i) Favorskii rearrangement
- (ii) Sommelet-Hauser rearrangement
- (iii) Neber rearrangement



**(C)Rearrangement involving migration to electron deficient nitrogen:**

- (i) Schmidt 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: Orton rearrangement, Hoffmann-Martius rearrangement, Rearrangement of N-nitrosoanilines (Fischer-Hepp rearrangement).

**(E) Rearrangement involving migration from oxygen to ring:**

- (i) Fries rearrangement
- (ii) Claisen rearrangement

**Reference Books Recommended:**

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 edition (2007)
6. Guidebook to organic synthesis-R K Meckie, D M Smith and R A Atken
7. Organic synthesis- Robert E Ireland
8. Strategic Applications of named reactions in organic synthesis-Laszlo Kurti and Barbara Czako
9. Organic Synthesis, Jagdamba Singh & L.D.S. Yadav, 6th edition, Pragati Prakashan (2010).
10. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh (McMillan India Ltd., 1976)
11. Advance Organic Chemistry, Reaction Mechanism and Structure by Jerry March, 4th ed. John Wiley & Sons, 1992



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**PAPER-II (Selected Topics in Organic Chemistry-II)**

**Max. Marks: 100 (External – 70 + Internal – 30)**

**Total Periods: 45**

**UNIT-I MASS SPECTROMETRY**

**(12 periods)**

Theory and principles of mass spectroscopy; Instrumentation; low and high resolution mass spectra; Ionization techniques – Electron Impact (EI) ionization, Chemical Ionization (CI), Field Desorption (FD), Fast Atom Bombardment (FAB), Electrospray Ionization (ESI); Determination of molecular weight and molecular formula, nitrogen rule, detection of molecular ion peak, metastable ion peak; Fragmentations – rules governing the fragmentations, McLafferty rearrangement; Interpretation of mass spectra of different class of compounds – saturated and unsaturated hydrocarbons, aromatic hydrocarbons, alcohols, ethers, ketones, aldehydes, carboxylic acids, amines, amides, compounds containing halogens; To write possible fragmentation for given compound; To identify structure from mass spectral data; To identify structure from combined spectral data.

*Structure elucidation by using UV, IR, NMR and Mass Spectroscopic techniques*

**UNIT-II STRUCTURE-REACTIVITY PRINCIPLES**

**(11 Periods)**

Types of mechanisms, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammonds postulate, Curtian-Hammet principle, potential energy diagrams, transition state and intermediates, methods of determining mechanisms- isotope effect.

Effect of structure on reactivity- resonance and field effect, steric effect, quantitative treatment. The Hammett equation and linear free energy relationships, substituent and reaction constants, positive and negative deviation from Hammett equation, Taft equation, Solvent effect

**UNIT-III HETEROCYCLIC CHEMISTRY-II**

**(11 Periods)**

(A) Five and six membered heterocycles with more than two hetero atoms: Synthesis, reactivity, aromatic character and importance of following heterocycles: 1,2,3-triazole, 1,2,4-triazole, 1,2,4-oxadiazole, 1,3,4-oxadiazole, 1,2,5-oxadiazole

(B) Condensed six membered heterocycles:

Synthesis, reactivity, aromatic character and importance of following heterocyclic Rings: Quinoline, Isoquinoline, Cinnoline, Quinoxaline, Phthalazine, Naphthyridine, Phenoxazine

**UNIT-IV SYNTHETIC AND BIO-POLYMERS**

**(11 Periods)**

**Bio-polymers:** General introduction, types, properties and uses of polysaccharides – starch and cellulose



**Synthetic polymers:** General introduction, method of preparation, properties and uses of Polyester, poly-tetrafluoroethylene, polyamino acids, polycyanoacrylates,

polyurethanes, silicone rubbers, polyphosphazenes, divinylether - maleic anhydride cyclopolymer (DIVEMA) polymeric antioxidants,

**Reference Books Recommended:**

1. Spectroscopic Identification of Organic Compounds, R. M. Silverstein and F. X. Webster, 6th edition (John Wiley & Sons)
2. Introduction to Spectroscopy, D. L. Pavia, G. M. Lampman and G. S. Kriz, 3rd edition (Thomson Brooks/Cole)
3. Spectroscopic Methods in Organic Chemistry, D. H. Williams and I. Fleming, 4th edition (McGraw - Hill Book Company)
4. Organic Spectroscopy, William Kemp, 3rd edition (Palgrave)
5. Organic Spectroscopy - Principles and Applications, Jag Mohan, 2nd edition (Narosa Publishing House)
6. Spectroscopy of Organic Compounds, P. S. Kalsi, 5th edition (New Age International Publishers)
7. Elementary Organic Spectroscopy: Principles and Chemical applications (revised edition), Y. R. Sharma (S. Chand Publishing)
8. Organic Chemistry by Francis A. Carey (McGraw-Hill Book Co., 1987).
9. Structure and Mechanism in Organic Chemistry, C. K. Ingold, Cornell Uni. Press.
10. Principles of Organic Synthesis, R.O.C. Norman and J. M. Coxon, Blackie Academic and Professional.
11. Reaction Mechanism in Organic Chemistry, S. M. Mukherji and S. P. Singh, Macmillan.
12. Organic Chemistry - J. Clayden, N. Greeves, S. Warren and P. Wothers
13. An introduction to the chemistry of heterocyclic compounds-R M Acheso
14. Heterocyclic Chemistry- J A Joule and Smith
15. Heterocyclic Chemistry-II- R R Gupta, M Kumar, V Gupta, Springer (India) pvt
16. Heterocyclic Chemistry, 4th Edition by J. A. Joule & K. Mills, Published by Chapman & Hall (1995)
17. Principles of modern heterocyclic chemistry, Edited by Leo A. Paquette, Published by Pearson Benjamin Cummings (1968)
18. Heterocyclic Chemistry, 3rd Edition by Thomas L. Gilchrist, Published by Prentice Hall (1997)
19. The Structure & Reactions of Heterocyclic Compounds, Edited by Michael Henry Palmer, Published by Edward Arnold (1967)
20. Heterocyclic chemistry by V. K. Ahluwalia, Narosa publishing house.
21. Harry R. Allcock, Frederick W. Lampe and James E. Mark, Contemporary Polymer Chemistry, 3rd edition, Pearson Prentice Hall, 2005.
22. Organic Polymer Chemistry by K. J. Saunders.



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**PAPER-III (Advance Organic Synthesis)**

**Max. Marks: 100 (External – 70 + Internal – 30)**

**Total Periods: 45**

**UNIT-I PROTECTING GROUPS**

**(12 Periods)**

Need of protecting groups – Protection of alcohols, Carbonyl, Carboxylic acid and amino groups, Synthetic equivalent groups and examples on transformations

**UNIT-II DISCONNECTION APPROACH**

**(11 Periods)**

Introduction to disconnection, Concept of synthon, Synthetic equivalent, Functional group interconversion

**(i) One group disconnection:**

Disconnection and synthesis of alcohols, olefins, simple ketones, acids and its derivatives

**(ii) Two groups disconnection:**

Disconnections in 1,3-dioxygenated skeletons, preparation of  $\beta$ -hydroxy carbonyl compounds,  $\alpha,\beta$ -unsaturated carbonyl compounds, 1,3-dicarbonyls, 1,5-dicarbonyls and use of Mannich reaction

**(iii) Pericyclic reactions:**

Disconnections based on Diels-Alder reaction and electrocyclic reaction: Its use in organic synthesis

**UNIT-III RING SYNTHESIS**

**(11 Periods)**

**Introduction to ring synthesis**

(i) Synthesis of saturated heterocycles: Synthesis of 3 and 4 membered rings

(ii) heterocycles in organic synthesis:

Synthesis of alkanes and cycloalkanes from thiophene, Synthesis of alkenes and cycloalkenes from pyridines,

Synthesis of Aromatic compounds from pyrilium salts, pyridazine, thiophenes and furan

**UNIT-IV ORGANOMETALLIC COMPOUNDS AND THEIR APPLICATIONS (11 Periods)**

(i) Carbon-metal bonds in organometallic compounds, Synthesis and applications of Organolithium, Organozinc and Lithium diorganocuprate.

(ii) Basic concept of organoboranes, Preparation of organoboranes, Stereochemistry of hydroboration, Mechanism of hydroboration – oxidation, Synthetic applications.

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2. Organic chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford Press).
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6. Guidebook to organic synthesis-R K Meckie, D M Smith and R A Atken.
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9. Organic Synthesis, Jagdamba Singh & L.D.S. Yadav, 6th edition, Pragati Prakashan (2010).
10. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh (McMillan India Ltd., 1976).
11. Advance Organic Chemistry, Reaction Mechanism and Structure by Jerry March, 4th ed. John Wiley & Sons, 1992.
12. Designing Organic Synthesis – A Programmed Introduction to the Synthron Approach, Stuart Warren, John Wiley & Sons (1994).
13. Organic Synthesis: The disconnection approach, Stuart Warren, John Wiley & Sons (1994).
14. Selected Organic Synthesis, Ian Fleming, John Wiley & Sons (1977).
15. Principles of Organic Chemistry by R.O.C. Norman (Chapman and Hall, 1986).
16. Organometallic Chemistry by P. L. Pauson (Edward Arnold, 1968).
17. Principles of Organometallic Chemistry by Coats, Green, Powell & Wade (Chapman and Hall, 1977).



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**PAPER-IV (Medicinal Chemistry-II)**

**Max. Marks: 100 (External – 70 + Internal – 30)**

**Total Periods: 45**

**UNIT-I ANTIBIOTICS**

**(11 Periods)**

General introduction and classification of antibiotics

Broad spectrum antibiotics, Macrolide antibiotics, Amino glycoside antibiotics and Non-classifiable antibiotics

**(i)  $\beta$ -lactam antibiotics:**

Penicillins (Structural variations and SAR), Cephalosporins (Structural variations)

**(ii) Non-lactam antibiotics:**

Tetracyclin (Structural variations and SAR)

Structures and medicinal importance/ clinical uses/ pharmacological applications of the following:

Bacitracin, Vancomycin, Erythromycin, Lincomycin, Chloramphenicol, Nalidixic acid, Norfloxacin, Ciprofloxacin

Synthesis and therapeutic uses of only the following:

Methicillin, Ampicillin, Cephalixin, Chloramphenicol, Ciprofloxacin

**UNIT-II ANTIALLERGIC AND LOCAL ANTI INFECTIVE DRUGS**

**(12 Periods)**

**(A) Antihistamines and related Antiallergic Drugs:**

General introduction and mode of action, Structure variation in Aminoalkylethers, Ethylenediamines and Piperazine derivatives.

Synthesis and therapeutic uses of only the following:

Diphenhydramine (Benadryl), Antazoline, Chlorpheniramine, Primethazine

**(B) Anti – mycobacterial agents:**

General Introduction of Tuberculosis & Leprosy-disease, Treatment, Mode of action, adverse effect of Anti TB agents & Anti-leprotic agents

Synthesis and therapeutic uses of only the following: Ethionamide, Ethambutol, DDS (Dapsone), Pyrazinamide.

**(C) Sulfonamides:**

General classification, mode of action and SAR Synthesis and therapeutic uses of only the following:

Sulfamethoxine (Sufadoxine), Sulfamethoxy-Pyrazine (Sulfalene), Succinyl sulfathiazole (Sulfasuxidine)



### UNIT-III Antimalerials and Antineoplastic agents

(11 Periods)

#### (A) 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, Chloroquine, Primaquine, Pyrimethamine (Daraprim), Quinacrine

#### (B) Antineoplastic Agents (Cancer Chemotherapy):

Introduction to cancer, types, Causes & Treatment of cancer, Metastasis, 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 (CCS) Agents, Mode of action,

Synthesis and therapeutic uses of only the following:

Mechlorethamine, Cyclophosphamide, Melphalan, 6-Mercaptopurine, Trimetrexate, Cytarabine

### UNIT-IV Anti-Viral and Anti-HIV agents

(11Periods)

#### (A) Antiviral agents:

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)

#### (B) Anti-HIV Drugs:

Introduction, HIV Infection and its Pathological Effects, HIV Structure and life cycle, Targets for Drug Design of Anti-HIV Agents, HIV drugs in clinical use, Development of Drug Resistance, the need for new Anti-HIV Drugs, Introduction of AIDS

Synthesis and therapeutic uses of only the following: Amantadine, Acyclovir, Zidovudine, Indinavir, Ritonavir

#### Reference Books Recommended

1. Burger's Medicinal Chemistry and Drug Discovery (5/e), 1997, Vol. 1, 2, 3, 4,5, Edited by 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 Febiger, 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 (Editor) (Interscience, 1968).
10. Adhunik Sanshleshit Aushodhonu Rasayanvighyan, Dr. Anamik Shah, University Granth Nirman Board, Ahmedabad.
11. Medicinal Chemistry, D. Sriram and P. Yogeewari, 1st edi., Pearson Education, 2007.
12. Handbook of pharmaceutical chemicals by Dr. A. R. Shenoy and Dr. V. R. Shenoy Multitech Publishing Co., 15-Yogesh, Hingwala Lane, Ghatkopar (East) Mumbai.
13. Fundamentals of Medicinal Chemistry by G Thomas.



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**M.Sc. - Semester - IV**  
**Organic Chemistry**  
**(PRACTICALS)**

1	Spectral Exercise	4- Credit
2	Preparation of organic compounds	
3	Green Synthesis	4- Credit
4	Viva-Voce	

**1 Spectral Exercise (Minimum 10 from syllabus)**

Structure interpretation of organic compounds from spectra (UV, IR, NMR and Mass)

**2 Preparation of industrially important compounds (Minimum 8)**

1. Sulfanilamide from via p-acetamido benzene sulphonyl chloride and acetamido benzene-sulfonamide.
2. Acridone from anthranilic acid via o-chloro benzoic acid and N-phenylanthranilic acid
3. Benzocaine from p-nitro toluene via p-nitro benzoic acid and p-amino benzoic acid.
4. Eosin from phthalic acid via phthalic anhydride and fluorescein.
5. Benzanilide from benzene via Benzophenone and Benzophenoxime.
6. p-Nitro chloro benzene from acetanilide via p-nitro acetanilide and p-nitroaniline.
7. p-Chloro bromo benzene from acetanilide via p-bromo acetanilide and p-bromoaniline.
8. Anthrone from phthalic anhydride via o-benzoyl benzoic acid and anthraquinone.
9. 4-Methyl-7-hydroxy-8-acetyl coumarin from resorcinol via 4-methyl-7-hydroxycoumarin and 4-methyl-7-acetyl coumarin.
10. Preparation of Congo red dye from naphthionic acid via hydrozobenzene.
11. Preparation of o & p-hydroxyacetophenone from Aniline via phenol and phenylacetate.

**3 Green Synthesis (Any Four)**


1. Green approach for preparation of bezopinacolone from bezopinacol using iodine catalyst
2. Preparation of 1, 1-bis-2-naphthol under grinding at room temperature
3. Three component coupling reaction by green approach. (Synthesis of dihydropyrimidinone)
4. Green approach to Transesterification reaction (Synthesis of biodiesel)
5. Ecofriendly nitration of phenols and its derivatives using Calcium nitrate



**Reference Books Recommended:**

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)



  
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