SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR

SYLLABUS EFFECTIVE FROM: 2018-19
M.Sc. CHEMISTRY
SEMESTER-IV
ORGANIC CHEMISTRY

(Total 650 marks)

Course Code	Course Title	Hours per week	Internal Marks	External Marks	Total Marks
PS04CORC21	Natural Products	4 hrs	30	70	100
PS04CORC22	Medicinal Chemistry	4 hrs	30	70	100
PS04CORC23	Stereochemistry of Organic Compounds	4 hrs	30	70	100
PS04EORC21-22	Any One	4 hrs	30	70	100
PS04CORC24	Practical **OR**	8 hrs	30	70	100
PS04CORC25	Project Work	8 hrs	30	70	100
PS04CORC26	Practical **OR**	8 hrs	30	70	100
PS04CORC27	Project Work	8 hrs	30	70	100
PS04CORC28	Comprehensive Viva	1 hr	-	50	50
Total Marks					650

*** Project work** (as optional) in place of practicals; to be offered to some of the students, based on their merit, interest and placement with the teachers (Marks : 200). The project shall have to be carried out under the allotted teacher(s) and a dissertation shall be submitted and will be assessed for internal (60 marks) and external (140 marks), in the usual manner.

Paper Code: PS04CORC21		Total Credit: 4
Title of Paper: Natural Products		
Unit	**Description in detail**	**Weightage**
1	**Introduction of Natural Products** Classification, source and methods of isolation of natural products, General methods for the structure determination of natural products. **Vitamins:** Structure and synthesis of Vitamin A_1, Vitamin B_1 (Thiamine), Vitamin B (Pyridoxine) and Biotin (Vitamin H). Synthesis of Vitamin C, Vitamin B_2 (Riboflavin).	25%
2	**Alkaloids** Introduction of Opium alkaloids, Structure and synthesis of Morphine, Rearrangement in opium alkaloids, synthesis of Reserpine and Tylophorine. Biogenesis of Alkaloids, Structure and synthesis of Cinchonine , Structure and synthesis of Tropine, Synthesis of 2-ethylpyridine, tropinic acid, tropinone and tropilidine from tropine, Synthesis of pimelic acid from tropinic acid	25%
3	**Terpenoids and Carotenoids** Structure and synthesis of cicyclic sesqiterpenoids Eudesmol and Cadinene,structure and synthesis of ß-Carotene, synthesis of Caryophyllene and (-) Khusimone, molecular rearrangement of Caryophyllene and Logifolene. Biogenesis of Terpenoids and Carotenoids.	25%
4	**Steroids** Structure and synthesis of Cholesterol, **Steroid Hormones:** Introduction, Androgens: Synthesis of Testosterone, Oestrogens: Total Synthesis of Oestrone Gestrogens: Synthesis of Progesterone from cholesterol. Synthesis of Cortisone, and Chemistry of bile acids. Biogenesis of Steroids.	25%

Basic Text & Reference Books:-

1. The Chemistry of Natural Products, K. W. Bentley, Vol. I – V (Interscience).
2. Organic Chemistry, Vol. 2, I. L. Finar, 5th Edition (1994) ELBS Publication.
3. Natural Products Chemistry, Vol. I & II K. Nakanishi et al., Academic press publication (1974).
4. The Molecules of Nature, J. B. Hendrickson, W. A. Benjamin Inc. (1965).
5. Selected Organic Synthesis, Ian Fleming John Wiley (1977).
6. Chemistry of Natural Products, N. R. Krishnaswamy, University Press (India) Ltd. (1999).
7. Classical Methods in Structure Elucidation of Natural Products, Reinhard W. Hoffmann by Wiley-VHCA.

Paper Code: PS04CORC22		Total Credit: 4
Title of Paper: Medicinal Chemistry		
Unit	**Description in detail**	**Weightage**
1	**Introduction to Medicinal Chemistry, Pharmacokinetics** Drug administration, Drug absorption, drug distribution, drug Metabolism (general pathway of drug metabolism: Oxidative, reductive and hydrolytic reactions), Drug excretion. Time course of drug action; First order and zero order, Time course of drug concentration change in plasma, Plateau effect. **Pharmacodynamics:** Receptors, Chemical messengers, Binding sites, Receptor types and subtypes (protein receptors, DNA receptors with examples of Agonists and Antagonists).	25%
2	**Psychoactive Drugs** **Sedative And Hypnotics**: Classifications, SAR of Barbituric acid, Synthesis of Glutethimide, Oxazepam and methaquilone. **Antianxiety agents:** Introduction, Classification, SAR of Benzodiazepine, Mode of action; Synthesis and uses: Diazepam, Nitroazepam, Maprobamate, Hydroxyzine. **Antidepressants:** Introduction, Classification, Synthesis and uses: Isocarboxazide, Imipramine, Sertraline, Venlafaxine. **Antipsychotics**: Introduction, Classification, Synthesis and uses: Chlorpromazine, Thioridazine, Trifluoperazine, Haloperidol, Trifluperidol, Loxapine and Clozapine. **Cardiovascular Drugs** **Antianginal and Vasodilators**: Introduction and Classifications, Synthesis of Nitroglycerine, Nicorandil, Nifedipine , Bepridil, Minoxidil and Hydralazine and SAR of Dihydropyridines. **Antihypertensive drugs:** Introduction and Classifications, Synthesis of Captopril, Ramipril.	25%
3	**Antineoplastics Agents**: Introduction, Classification, synthesis and drug profile. **Alkylating agents:** Melphalan, cyclophosphamide and dacarbazine. **Topoisomerase inhibitors:** Doxorubicin etoposide and dactinomycin. **Antimetabolites:** Mercaptopurine methotrexate and gemcitabine. **Tubulin binders:** Docetaxel paclitaxel and vincristine**.** **Antiviral Agents:** Introduction, Classification of drugs according to its mechanism of action and according to the treatment protocol. **Drug profile based on Nucleotide analogues:** Acyclovir, Idoxuridine, Rimantadine, **None Nucleoside RT inhibitors:** Nevirapine, Emivirine. **Nucleoside RT inhibitors:** Zalcitabine, Zidovudine. **HIV protease inhibitors:** Indinavir, Ritonavir.	25%
4	**Antibiotics:** General Introduction, Chemical Classification. **ß-lactam antibiotics:** Penicillins, Cephalosporins, ß-lactamase inhibitors, Aminoglycosides, Tetracyclines, Chloramphenicol,	25%

	Quinolone antibacterials. **Drug Design:** Concepts of drug design, Approaches to lead discovery, SAR, Combinatorial chemistry, Pro-drugs.	

Basic Text & Reference Books:-

1. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical, Chemistry, 11th Edition by John H. Block & John M. Beale, Published by Lippincott Williams & Wilkins (2004).
2. Principles of Medicinal Chemistry, 4th Edition by William O-Foye, Thomas L. Lemke and David A.Williams, Published in India by B. I. Waverly Pvt. Ltd. New Delhi (1995).
3. Essential of Medicinal Chemistry, 2nd Edition by Andrejus korolkovas, Published by Wiley-India Edition (1988).
4. Instant Notes: Medicinal Chemistry, Edited by Graham L. Patric, Published by Viva Books Private Ltd. (2002)
5. Textbook of Medicinal Chemistry Vol. I & II by V. Alagarsamy Published by Elsevier (2010).
6. Medicinal Chemistry 3rd Edition by Ashutosh Kar Published by New age international (P) Limited,Publishers (2005).
7. Medicinal Chemistry Edited by Alfred Burger Published by Interscience Publishers, John Wiley & Sons,New York (1951)
8. Burger's Medicinal Chemistry and Drug Discovery Vol. 3: Therapeutic agents Edited by Manfred E. Wolff Published by Interscience Publishers, John Wiley & Sons, New York (1996)
9. Burger's Medicinal Chemistry 4th Edition : Part III Edited By Manfred E. Wolff Published by Interscience Publishers, John Wiley & Sons, New York (1981)
10. Organic Chemistry, Vol. 2, I. L. Finar, 5th Edition (1994) ELBS Publication.
11. Natural Products Chemistry, Vol. I & II K. Nakanishi et al., Academic press publication (1974).
12. The Molecules of Nature, J. B. Hendrickson, W. A. Benjamin Inc. (1965).
13. Selected Organic Synthesis, Ian Fleming John Wiley (1977).
14. Chemistry of Natural Products, N. R. Krishnaswamy, University Press (India) Ltd. (1999).

Paper Code: PS04CORC23		Total Credit: 4
Title of Paper: Stereochemistry in Organic Compounds		
Unit	**Description in detail**	**Weightage**
1	**Asymmetric Synthesis** Introduction, Chemoselectivity, Regioselectivity, Stereoselectivity; Methodology of Asymmetric Synthesis; Classification of Asymmetric reactions: Substrate controlled, Chiral auxiliary controlled, Chiral reagent controlled and Chiral catalyst controlled; Substrate controlled asymmetric synthesis: Nucleophillic addition to carbonyl compounds; 1,2 – Asymmetric induction, Cram's rule, Prelog's rule and Felkin – Anh model; Asymmetric aldol reaction; Diastereoselective aldol reaction, Chiral auxiliary controlled asymmetric synthesis: α – Alkylation of chiral enolates, oxazoline; Use of chiral auxiliary in Diels – Alder reaction; Chiral reagent controlled asymmetric synthesis: Asymmetric reduction using BINAL – H; Asymmetric hydroboration using IPC2BH and IPCBH2; Reduction with CBH reagent. M. P. V. Reduction; Chiral catalyst controlled asymmetric synthesis: Sharpless epoxidation; Asymmetric hydrogenations using chiral Wilkinson bisphosphine.	25%
2	**Resolution and Conformational Analysis** Resolution: Principle; General methods for resolution; Resolution of (±)-2-octanol, (±)-phenylethylamine, (±)-alanine. Conformational analysis of acyclic compounds.	25%
3	**Conformational Analysis** Conformational analysis of cyclic, fused, and bridged cyclic ring systems.	25%
4	**Molecular Recognition, Chemical and Stereochemical Aspects** Introduction; DNA: Structure, replication and formation of double helix; Protein and enzyme; Synthetic molecular receptors; Enantioselective molecular recognition; Molecular recognition and catalysis; Molecular self-assembly.	25%

Basic Text & Reference Books:-

1. Stereochemistry: Conformation and Mechanism, By P.S. Kalsi, 6th edition, New Age International (P) Ltd., Publishers (2005).
2. Stereochemistry and Mechanism through solved problems, By P.S. Kalsi, Wiley Eastern Ltd. (1994).
3. Stereochemistry of organic compounds, By D. Nasipuri, 2nd Edition, New Age International (P) ltd., Publishers (1994).
4. Stereochemistry of Carbon Compounds, By E.L. Eliel, Tata McGraw-Hill Pub. Co. Ltd. (1962).
5. Organic Chemistry, By J. Clayden, N. Greeves, S. Warren and P. Wothers, Oxford Uni. Press, N.Y. (2001).

Paper Code: PS04EORC21		Total Credit: 4
Title of Paper: Topics in Organic Chemistry		
Unit	**Description in detail**	**Weightage**
1	**Organometallic Chemistry** Transition metals in Organic reactions; 18-electron rule; Bonding and reactions in transition metal complexes: oxidative addition, reductive elimination, insertion reaction; Role of palladium in homogenous catalysis; Heck reaction; Cross coupling of organometallics and halides: Stille coupling, Suzuki coupling, Sonogashira reaction, Hiyama coupling, Kumada coupling, Zimmerman coupling; Allylic electrophile activation by Pd(0); Pd catalyzed amination of aromatic ring; Nucleophilic attack to Pd(II)-alkene organometallic complexes, Metathesis reactions.	25%
2	**Name Reactions and Reagents** Sharpless asymmetric hydroxylation, Staudinger reaction, Corey-Fuchs reaction, Ritter reaction, Nef reaction, Mcmurry reaction, Luche reduction, Wacker oxidation, TEMPO, Noyori asymmetric hydrogenation.	25%
3	**Sulfur, Silicon and Phosphorous in Organic Chemistry** Sulfur and organosulfur compounds; Sulfur stabilized anions; Sulfonium salts; Sulfonium ylids, Reactivity comparison of silicon and carbon; Allyl silanes as nucleophiles; Role of S. Si and P in alkene synthesis; Stereoselective synthesis of alkene; Julia olefination; Peterson reaction, Witting reaction.	25%
4	**Organic Chemistry – Problem Solving in Context to Competitive Examinations** Solving problems based on reaction mechanism, reagents, spectroscopy and stereochemistry with special emphasis on current research.	25%

Basic Text & Reference Books:-

1. Organic Chemistry by J. Clayden, N. Greeves and S. Warren, 2nd edition, Oxford University Press, UK.
2. Modern Methods of Organic Synthesis; W. Carruthers and I. Coldham, 4th edition, Cambridge University Press, UK.
3. Name Reaction for Functional Group Transformation, E. J. Corey and Jie Jack Lie, John Wiley and Sons, New Jersey.
4. Name Reactions, Jie Jack Lie, 4th edition, Springer, New York.
5. Selected Organic Synthesis, Ian Fleming, John Wiley & Sons, New Jersey.

Paper Code: PS04EORC22		Total Credit: 4
Title of Paper: Applied Organic Chemistry		
Unit	**Description in detail**	**Weightage**
1	**Organic Chemistry in Industry** Introduction, Process Chemistry *versus* Research Chemistry, Pharmaceutical Industry: Drug Discovery, Drug development-Preclinical and clinical testing, Medicine, Future Problems and Opportunities. Agrochemical Industry: Herbicides, Fungicides and Insecticides. Dyes Industry: Textile and Food dyes.	25%
2	**Organic Chemistry and Environment** Introduction, Pesticides, Focus on POPs and VOCs, Endocrine Disruptors, Chlorofluorocarbons and their Replacements, Polycyclic Aromatic Hydrocarbons, Plastics, Green Chemistry and the future.	25%
3	**Organic Chemistry in Forensic Science** Introduction, Drugs of Abuse: Categories, Presumptive Tests, Instrumental Methods and Designer Drugs, Poisoning, Testing of Blood, Dyes, Inks and Paper, Trace Evidence, Fingerprints Visualization.	25%
4	**Organic Reactions Catalysis** Introduction, Catalysis by Acids and Bases, Lewis Acid Catalysis, Phase-Transfer Catalysis, Reactions Catalyzed by Metal Surfaces and Transition Metal Complexes, Enzyme and Organocatalysis.	25%

Basic Text & Reference Books:-

1. Organic Chemistry: A Mechanism Approach; Penny Chaloner, CRC Press, Tailor and Francis; Florida.
2. Pharmaceutical Process development: Current Chemical and Engineering Challenges, J. Blacker and M. T. Williams, RSC Cambridge, UK.
3. Fine Chemicals: The Industry and Its Business, P. Pollak, 2nd Edition, Wiley.
4. The Evolution of Drug Discovery: From Traditional Medicines to Modern Drugs, E. Ravina, Wiley.
5. Name Reactions, Jie Jack Lie, Fourth edition, Springer, New York.
6. Catalysis of Organic Reactions, John R. Sowa, Jr., CRC Press, Tailor and Francis, Florida.

Paper Code: PS04CORC24	**Total Credit: 4**
Title of Paper: Practical in Organic Chemistry	

Description in detail	**Weightage (%)**
Multistep Synthesis of Heterocyclic Compounds	100%

Multistep Synthesis of Heterocyclic Compounds (Minimum Sixteen (16) exercises)

- To monitor reaction by Thin Layer Chromatography (TLC)

1. Acridone
2. Antipyrin
3. Phenacetin
4. 2-Methylbenzimidazole
5. 2-Benzylbenzimidazole
6. 2-ChloroPhenylbenzimidazole
7. Preparation of heterocyclic azo dye
8. 5-Chloro-3-methyl-1-phenyl-1H-pyrazolone-4-carboxaldehyde
9. 2-Phenylindole
10. 5-Nitroanthranilic acid
11. 2-Methyl-3-benzyl-4-ketoquinazoline
12. 2,3-Dimethyl4-ketoquinazoline
13. 2-Styryl-3(H)-4-ketoquinazoline
14. Flavone
15. 2-Chloro-3-formyl-quinolones
16. 5-Hydroxy-1,3-benzoxathiazolone-2
17. *p*-Aminobenzene sulfonamide (Sulfa drug),
18. 2-Chloromethylbenzimidazole
19. 3-(4-Carbonyl-1-phenylpyrazol-3-yl)chromen-2-one
20. Miscellaneous

Basic Text & Reference Books:-

1. Vogel's Textbook of practical organic chemistry, 5th edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell (Pearson Education)
2. Comprehensive practical organic chemistry: Qualitative analysis, V. K. Ahluwalia, SunitaDhingra (Universities Press)
3. Organic structures from spectra, 5th edition, L. D. Field, S. Sternhell, J. R. Kalman (Wiley: A John Wiley & Sons Ltd publication)
4. Elementary Organic Spectroscopy: Principles and Chemical applications (revised edition), Y. R. Sharma (S. Chand Publishing)

Paper Code: PS04CORC26	**Total Credit: 4**
Title of Paper: Practical in Organic Chemistry	

Description in detail	**Weightage (%)**
Synthesis of Some Drugs and Intermediates, Synthesis of Various Esters, Demonstration of column chromatography, Spectral Analysis	100%

A. Synthesis of Some Drugs and Intermediates (08 excersises)
   1. Yarayara (2-methoxy naphthalene)
   2. 5,5'-Diphenylhydantoin
   3. Benzimidazole
   4. Benzotriazole
   5. 2-Hydroxy-4-methylquinoline
   6. 2,3-Diphenylquinoxaline
   7. 6-Methyl-4-oxo-1,3,-dihydro-2-thiopyrimidine
   8. Ethyl-6-methyl-2-oxo-4-phenyl-1,3,4-trihydro-5-pyrimidinecarboxylate

B. Synthesis of Various Esters (07 exercises)
   1. Benzocain (Ethyl-p-aminobenzoate)
   2. Dibutyl maleate
   3. Ethyl Cinnamate
   4. Butesin (Butyl-4-aminobenzoate)
   5. Isobutyl phenylacetate
   6. Salol (Phenyl Salicylate)
   7. Ethylphenylacetate

C. Demonstration of Column Chromatography

D. Spectral Analysis
   Structure interpretation of organic compounds from spectra.
   Minimum eight (08) exercises should be given.

Basic Text & Reference Books:-

1. Vogel's Textbook of practical organic chemistry, 5th edition, B. S. Furniss, A. J. Hannaford, 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).

OR

PS04CORC25 and PS04CORC27

*** Project work** (as optional) in place of practicals; to be offered to some of the students, based on their merit, interest and placement with the teachers (Marks : 200). The project shall have to be carried out under the allotted teacher(s) and a dissertation shall be submitted and will be assessed for internal (60 marks) and external (140 marks), in the usual manner.

Paper Code: PS04CORC28	**Total Credit: 1**
Title of Paper: Comprehensive Viva	

Description in detail	**Weightage (%)**
Viva Voce From the Subjects Studied in Semester - IV	100%