



**JAI HIND COLLEGE
BASANTSING INSTITUTE OF SCIENCE
&
J.T.LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)**

"A" Road, Churchgate, Mumbai - 400 020, India.

**Affiliated to
University of Mumbai**

Program: M.Sc. Chemistry
(Organic)

Course: Theoretical Organic Chemistry I

Semester III

**Credit Based Semester and Grading System (CBSGS) with effect from
the academic year 2022-23**

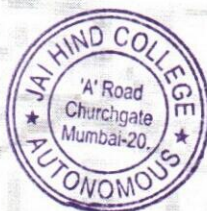



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M.Sc. Theoretical Organic Chemistry I Syllabus

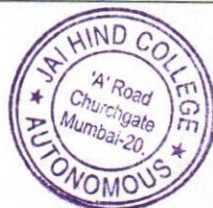
Semester III			
Course Code	Course Title	Credits	Lectures/Week
PSCHE3301	Theoretical Organic Chemistry I	04	04




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Semester III – Theory

Course: PSCHE3301	Theoretical Organic Chemistry-I (Credits: 04 Lectures/Week: 04)
	Organic Reaction Mechanism, Pericyclic reactions, Stereochemistry & Physical Organic Chemistry
	Objectives: <ol style="list-style-type: none"> 1. To understand advance techniques of organic reaction like photochemistry, electro organic, pericyclic. 2. To understand reaction and mechanism organic products. 3. To understand stereochemistry of cycloalkanes and fused ring. Outcomes: <ol style="list-style-type: none"> 1. To predict correct stereochemical conformations of cycloalkanes and fused ring. 2. To explain the concept of advance organic reactions.
Unit I	Organic Reaction Mechanism 15L <ol style="list-style-type: none"> 1.1 Organic reactive intermediates, methods of generation, structure, stability and important reactions involving carbocations, carbanions, free radicals, carbenes, nitrenes. [3L] 1.2 Neighbouring group participation: Recapitulation- mechanism and effects of anchimeric assistance, NGP by unshared/ lone pair of electrons & aryl rings; participation by π-electrons, cyclopropyl ring & σ-bonds with special reference to norbornyl and bicyclo[2.2.2]octyl cations systems (formation of non-classical carbocation) [7L] 1.3 Role of FMOs in organic reactivity: Recapitulation of Salem Klopman equation, hard and soft electrophiles & nucleophiles; SET in ionic reactions; Nucleophilicity: heteroatom nucleophiles, alkene nucleophiles, alpha effect, ambident nucleophiles; Aromatic Electrophilic Substitution; Electrophilicity: trigonal and ambident electrophiles [5L]
Unit II	Pericyclic Reactions 15L <ol style="list-style-type: none"> 2.1 Introduction to Pericyclic Reactions: Characteristics of Pericyclic Reactions, Classification of Pericyclic Reactions, Evidence for the concertedness of bond making and breaking, Identification of Systems, Molecular orbital symmetry, Frontier orbital of ethylene, 1,3 butadiene, 1,3,5 hexatriene and allyl system, Con and Dis rotation, Supra and antra facial addition. [3L] 2.2 Electrocyclic reactions: Con rotatory and dis rotatory in ring



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	<p>opening and ring closing system, Symmetry allowed and forbidden conditions for thermal and photochemical conditions, Explanation for above using following theories: Frontier Molecular Orbital (FMO), Correlation diagrams & Woodward-Hofmann rules, Hückel Mobius or PMO method [4L]</p> <p>2.3 Cycloaddition reactions: [4n] cycloadditions, [4n+2] cycloadditions, 2+2 additions of ketenes; Selection rule and explanation using following theories: Frontier Molecular Orbital (FMO), Correlation diagrams & Woodward-Hofmann rules, Hückel Mobius or PMO method; Diels-Alder reactions, ene reaction, 1, 3-Dipolar cycloaddition and cheletropic reactions. (Regioselectivity, site selectivity and effect of substituents in Diels-Alder reactions.) [4L]</p> <p>2.4 Sigmatropic rearrangements: H-shifts and C-shifts, supra and antarafacial migrations, retention and inversion of configurations, Selection rule. Cope (including oxy-Cope and aza-Cope) and Claisen rearrangements [2L]</p> <p>2.5 Synthesis using Pericyclic reactions: Formation of Vitamin D from 7-dehydrocholesterol, synthesis of Citral, conversion of Endiandric acid E to Endiandric acid A. [2L]</p>	
<p>Unit III</p>	<p>Stereochemistry-I</p> <p>3.1 Conformations of cycloalkanes- strains in cycloalkanes & I-strain concept; conformations of cyclohexane, stabilization of flexible conformers; mono & disubstituted cyclohexane; cyclohexanones and alkylidenecyclohexane. [4L]</p> <p>3.2 Conformational analysis of medium rings: Eight to ten membered rings and their unusual properties, transannular reactions. [2L]</p> <p>3.3 Stereochemistry of fused ring and bridged ring compounds: decalins, hydrindanes, perhydroanthracenes, steroids, and Bredt's rule. [4L]</p> <p>3.4 Anancomeric systems, Effect of conformation on reactivity of cyclohexane derivatives in the following reactions (including mechanism): electrophilic addition, elimination, molecular rearrangements, reduction of cyclohexanones (with LiAlH_4, selectride and MPV reduction) and oxidation of cyclohexanols. [5L]</p>	<p>15L</p>



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Unit IV	<p>Organic Photochemistry & Electrochemistry</p> <p>Photochemistry: [7L]</p> <p>4.1.1 Recapitulation of principles of photochemistry: electronic states and transitions, selection rules, fate of excited molecules (Jablonski diagram), photosensitization. [1L]</p> <p>4.1.2 Photochemistry of olefins: di-π-methane rearrangement including aza-di-π [1L]</p> <p>4.1.3 Photochemistry of carbonyl compounds: Paterno-Buchi reaction, photochemistry of enones, photochemical rearrangements of α,β-unsaturated ketones and cyclohexadienones, Photo Fries rearrangement, Barton reaction. [4L]</p> <p>4.1.4 Photochemistry of arenes: Photoisomerization of benzenoid compounds, Photoaddition of alkenes & alkynes to aromatic systems: 1,2- 1,3- and 1,4- additions. [1L]</p> <p>Electrochemistry: [8L]</p> <p>4.2.1 Introduction: Electrode potential, cell parameters, electrolyte, working electrode, choice of solvents, supporting electrolytes. [3L]</p> <p>4.2.2 Cathodic reduction: Reduction of alkyl halides, aldehydes, ketones, nitro compounds, olefins, arenes, electro-dimerization. [3L]</p> <p>4.2.3 Anodic oxidation: Oxidation of alkyl benzene, Kolbe reaction, Non-Kolbe oxidation, Shono oxidation [2L]</p>	15L
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Standard References:

Unit I

1. March's Advanced Organic Chemistry, Jerry March, sixth edition, 2007, John Wiley and sons.
2. A guide to mechanism in Organic Chemistry, 6th edition, 2009, Peter Sykes, Pearson education, New Delhi
3. Carbenes, Nitrenes and Arynes. Von T. L. Gilchrist, C. W. Rees. Th. Nelson and Sons Ltd., London 1969
4. Molecular Orbitals & Organic Chemical Reactions, Ian Fleming Reference Edition, Wiley Publication.

Unit II

5. Pericyclic Reactions, S. Sankararaman, Wiley VCH, 2005
6. Pericyclic reactions-A mechanistic approach, S. M. Mukherji, Macmillan Co. of India 1979
7. Photochemistry & Pericyclic Reactions, Jagdamba Singh, Jaya Singh, New Age Science Publication



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Unit III

8. Stereochemistry: A Three Dimensional Insight, Anil V. Karnik, Mohammed Hasan, First edition, 2021, Elsevier Publisher
9. Stereochemistry of Organic Compounds- Principles and Applications, D. Nasipuri. 4th Edition, New International Publishers Ltd
10. Stereochemistry of Carbon Compounds, E.L. Eliel, S.H. Wilen and L.N. Manden, Wiley

Unit IV

11. Advanced Organic Chemistry Part A: Structure & Mechanisms, Carey Francis A., Sundberg, Richard J., Fifth edition, 2007, Springer Publisher
12. Principles of Organic Synthesis, R.C. Norman, J. M. Coxon, 1993, Blackie Academic & Professional Publisher.

Additional References:

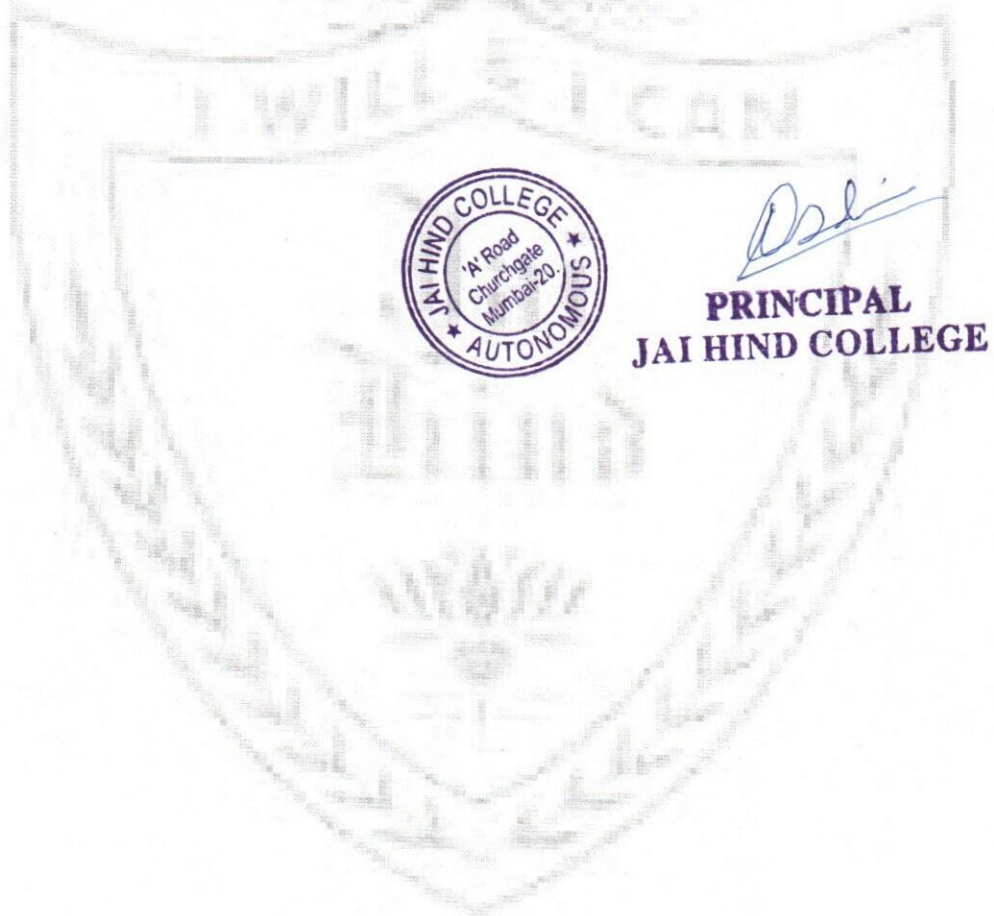
13. Advanced Organic Chemistry: Reaction Mechanisms, R. Bruckner, Academic Press (2002).
14. Mechanism and theory in Organic Chemistry, T. H. Lowry and K.C. Richardson, Harper and Row
15. Organic Reaction Mechanism, 4th edition, V. K. Ahluvalia, R. K. Parashar, Narosa Publication.
16. Reaction Mechanism in Organic Chemistry, S.M. Mukherji, S.P. Singh, Macmillan Publishers, India.
17. Organic Chemistry, Part A and B, Fifth edition, 2007, Francis A. Carey and Richard J. Sundberg, Springer
18. Organic reactive intermediates, Samuel P. MacManus, Academic Press.
19. Organic Chemistry, J. Clayden, S. Warren, N. Greeves, P. Wothers, 1st Edition, Oxford University Press (2001).
20. Organic Chemistry, Seventh Edition, R.T. Morrison, R. N. Boyd & S. K. Bhattacharjee, Pearson.
21. Advanced Organic Chemistry: Reactions & Mechanisms, second edition, B. Miller and R. Prasad, Pearson.
22. Organic reactions & their mechanisms, third revised edition, P.S. Kalsi, New Age International Publishers.
23. Organic Chemistry: Structure and Function, P. Volhardt and N. Schore, 5th Edition, 2012
24. Organic Chemistry, W. G. Solomons, C. B. Fryhle, 9th Edition, Wiley India Pvt. Ltd., 2009.
25. Advanced organic chemistry, Jagdamba Singh L. D. S. Yadav, Pragati Prakashan, 2011
26. Pericyclic reactions, Ian Fleming, Oxford university press, 1999
27. Organic chemistry, 8th edition, John McMurry
28. Modern methods of Organic Synthesis, 4th Edition W. Carruthers and Iain Coldham, Cambridge University Press 2004
29. Stereochemistry, P. S. Kalsi, 4th edition, New Age International Ltd
30. Organic Stereochemistry, M. J. T. Robinson, Oxford University Press, New Delhi, India edition, 2005



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Evaluation Scheme

- **Continuous Assessment (CA) – 40 Marks**
 - Knowledge and Application based: Objective test of 20 Marks
 - Skill based (20 marks): Learner will be assessed on relevant skills pertaining to the course content of a particular paper which could involve but not limited to
 - Oral Presentations on relevant topics
 - Review writing/Worksheets etc.
- **Semester End Examination (SEE)- 60 Marks**



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Program: M.Sc. Chemistry
(Organic)

Course: Synthetic Organic Chemistry I

Semester III

**Credit Based Semester and Grading System (CBSGS) with effect from
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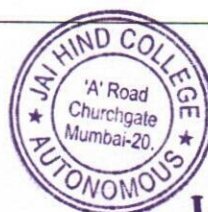

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M.Sc. Synthetic Organic Chemistry I Syllabus

Semester III			
Course Code	Course Title	Credits	Lectures/Week
PSCHE3302	Synthetic Organic Chemistry I	04	04

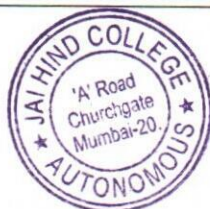
Semester III – Theory

Course: PSCHE3302	Synthetic Organic Chemistry I (Credits: 04 Lectures/Week: 04)	
	Name reactions, Radicals in organic synthesis, Metals & non-metals in synthetic organic chemistry	
	Objectives: 1. To understand the mechanism of name reactions. 2. To illustrate the application of radicals in organic chemistry. 3. To understand the application of metal and non-metals in organic synthesis. Outcomes: 1. To explain mechanism of novel reactions. 2. To discuss the importance of radicals in organic reactions. 3. To illustrate the application of metals and non-metals in organic synthesis.	
Unit I	Name reactions with mechanism and applications: 1.1 Mukaiyama esterification, Mitsunobu reaction, Darzen's Glycidic Ester synthesis, Ritter reaction, Yamaguchi esterification, Peterson olefination. [5L] 1.2 Domino reactions: Characteristics; Nazarov cyclization [3L] 1.3 Multicomponent reactions: Strecker Synthesis, Ugi 4CC, Biginelli synthesis, Hantzsch synthesis, <u>Pictet-Spengler synthesis</u> [5L] 1.4 Click Reactions: Characteristics; Huisgen 1,3-Dipolar Cycloaddition [2L]	15L
Unit II	Radicals in organic synthesis: 2.1 Introduction: Generation, stability, reactivity and structural and stereochemical properties of free radicals, Persistent and charged radicals, Electrophilic and nucleophilic radicals.[3L]	15L




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	<p>2.2 Radical Initiators: azobisisobutyronitrile (AIBN) and dibenzoyl peroxide. [1L]</p> <p>2.3 Characteristic reactions - Free radical substitution, addition to multiple bonds. Radical chain reactions, Radical halogenation of hydrocarbons (Regioselectivity), radical cyclizations, autoxidations: synthesis of cumene hydroperoxide from cumene. [4L]</p> <p>2.4 Radicals in synthesis: Inter and intra molecular C-C bond formation via mercuric hydride, tin hydride, thiol donors. Cleavage of C-X, C-Sn, O-O bonds. Oxidative coupling, C-C bond formation in aromatics: $S_{RN}Ar$ reactions. [4L]</p> <p>2.5 Hunsdiecker reaction, Pinacol coupling, McMurry coupling, Sandmeyer reaction, Acyloin condensation. [3L]</p>	
Unit III	<p>Metals/Non-metals in organic synthesis</p> <p>3.1 Mercury in organic synthesis: Mechanism and regiochemistry of oxymercuration and demercuration of alkenes, mercuration of aromatics, transformation of aryl mercurials to aryl halides. Organomercurials as carbene transfer reagents. [3L]</p> <p>3.2 Organoboron compounds: Mechanism and regiochemistry of hydroboration of alkenes and alkynes, asymmetric hydroboration using chiral boron reagents, 9-BBN hydroboration, oxazaborolidine (CBS catalyst) and functional group reduction by diborane. [3L]</p> <p>3.3 Organosilicons: Salient features of silicon governing the reactivity of organosilicons, preparation and important bond-forming reactions of alkyl silanes, alkenyl silanes, aryl silanes and allyl silanes. β-silyl cations as intermediates. Iodotrimethylsilane in organic synthesis. [3L]</p> <p>3.4 Silyl enol ethers: Application: As nucleophiles (Michael reaction, Mukaiyama aldol reaction), in ring contraction reactions. [2L]</p> <p>3.5 Organotin compounds: Preparation of alkenyl and allyl tin compounds; application in C-C bond formation, in replacement of halogen by H at the same C atom. [2L]</p> <p>3.6 Selenium in organic synthesis: Preparation of selenols/ selenoxide, selenoxide elimination to create unsaturation, selenoxide and seleno acetals as α-C-H</p>	15L



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	activating groups. [2L]	
Unit IV	<p>Transition metals in Organic Synthesis:</p> <p>4.1 Introduction to basic concepts: 18 electron rule, preparation, bonding in transition metal complexes: ML σ-complexes of alkyls and aryls; carbonyls, phosphines; π-complexes with alkenes, conjugated alkenes; carbenes, carbynes and N-heterocyclic carbenes. [4L]</p> <p>4.2 Reactions & mechanisms involved in organometallic chemistry: oxidative addition, reductive elimination, migratory insertion; β-hydride elimination.[4L]</p> <p>4.3 Palladium in organic synthesis: π-bonding of Pd with olefins, applications in C-C bond formation, carbonylation, alkene isomerisation, cross-coupling of organometallics and halides. Representative examples: Heck reaction, Suzuki-Miyaura coupling, Sonogashira reaction & Wacker oxidation. Heteroatom coupling for bond formation between aryl/vinyl groups and N, S or P atoms.[5L]</p> <p>4.4 Metathesis: alkene & alkyne metathesis, Schrock catalyst & Grubb's catalyst- I, II & III generations. [2L]</p>	15L

Standard References:

Unit I

1. Name Reactions- A collection of detailed mechanisms and synthetic applications, Jie Jack Li, Springer, 2021
2. Name Reactions & Reagents in Organic Synthesis, Bradford P. Mundy, Michael G. Eller, Frank G. Favalaro Jr., Wiley Publisher, Second Edition, 2005

Unit II

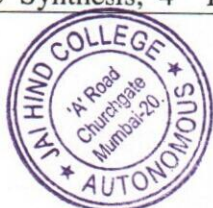
3. Organic Chemistry, J. Clayden, S. Warren, N. Greeves, P. Wothers, 1st Edition, Oxford University Press (2001).
4. Advanced Organic Chemistry, Part A & B: Reaction & Synthesis, Francis A. Carey, Richard J. Sundberg, 5th Edition, Springer Verlag

Unit III

5. Modern Methods of Organic Synthesis, 4th Edition, W. Carruthers and Iain Coldham, Cambridge University Press 2004
6. Organic Chemistry, Clayden Greeves Warren and Wothers, Oxford Press, 2001
7. Principles of Organic Synthesis, R.O.C. Norman & J.M. Coxon, 3rd Edition, Nelson Thornes.

Unit IV

8. The Organometallic Chemistry of the Transition Metals, Robert H. Crabtree, 6th Edition, John Wiley & Sons, Inc., Hoboken, New Jersey, 2014.
9. Modern Methods of Organic Synthesis, 4th Edition, W. Carruthers and Iain



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Coldham, Cambridge University Press 2004

Additional References:

10. Advanced Organic Chemistry: Reaction Mechanisms, R. Bruckner, Academic Press (2002).
11. Mechanism and theory in Organic Chemistry, T. H. Lowry and K.C. Richardson, Harper and Row
12. Organic Reaction Mechanism, 4th edition, V. K. Ahluvalia, R. K. Parashar, Narosa Publication.
13. Reaction Mechanism in Organic Chemistry, S.M. Mukherji, S.P. Singh, Macmillan Publishers, India.
14. Organic Chemistry, Part A and B, Fifth edition, 2007, Francis A.
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Program: M.Sc. Chemistry
(Organic)

Course: Natural Products and Heterocyclic Chemistry

Semester III

**Credit Based Semester and Grading System (CBSGS) with effect from
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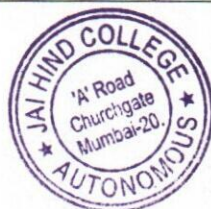
M.Sc. Natural Products and Heterocyclic Chemistry Syllabus

Semester III			
Course Code	Course Title	Credits	Lectures/Week
PSCHE3303	Natural Products and Heterocyclic Chemistry	04	04



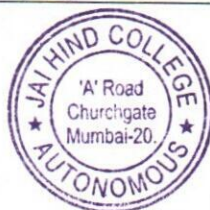
Semester III – Theory

Course: PSCHE3303	Natural Products & Heterocyclic Chemistry (Credits: 04 Lectures/Week: 04)	
	Bioorganic Chemistry, Natural Products & Heterocyclic Chemistry	
	Objectives: 1. To understand the structure of carbohydrates, amino acids, nucleic acid and steroids. 2. To elaborate the chemistry of natural products. 3. To understand the synthesis of heterocyclic compounds. Outcomes: 1. To draw the structure of carbohydrates, amino acids, nucleic acid and steroids. 2. To explain the chemistry of natural products. 3. To discuss the synthesis methods of heterocyclic compounds.	
Unit I	Bioorganic Chemistry 1.1 Carbohydrates: Introduction to naturally occurring sugars: Deoxysugars, aminosugars, branched sugars. Structural features and applications of inositol, starch, cellulose, chitin, heparin & cyclodextrins. [3L] 1.2 Amino acids, peptides & proteins: Amino acids, primary structure of proteins- amino acid sequencing; secondary structure of proteins- alpha helix & beta sheets; tertiary structure of protein: folding & domain structure; quaternary structure; chemical synthesis of peptides- Solid phase synthesis. [3L] 1.3 Nucleic acids: Structure and function of physiologically important nucleotides nucleotides (c-AMP, ADP, ATP) & nucleic acids (DNA & RNA), replication, genetic code & protein biosynthesis; reactions of nucleic acids with DPA & orcinol; chemical synthesis of oligonucleotides: phosphodiester, phosphotriester, phosphoramidite & H-phosphonate methods & solid phase approach. [4L] 1.4 Steroids: introduction, structure and stereochemistry, occurrence & biological role; synthesis of 16-DPA from diosgenin (Marker degradation) & synthesis of androsterone, & progesterone from 16-DPA. [5L]	15L
Unit II	Chemistry of Natural Products 2.1 Multi-step synthesis of natural products: [6L] a. Woodward synthesis of Reserpine from benzoquinone b. Corey synthesis of Longifolene from resorcinol	15L




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	<p>c. Synthesis of Juvabione from Limonene d. Gilbert-Stork synthesis of Griseofulvin from phloroglucinol</p> <p>2.2 Insect pheromones: General structural features & importance. Types of pheromones (aggregation, alarm, releaser, primer, territorial, trail, sex pheromones etc.), advantage of pheromones over conventional pesticides; synthesis of bombykol from acetylene, disparlure from 6-methylhept-1-ene, grandisol from 2-methyl-1,3-butadiene. [3L]</p> <p>2.3 Insect growth regulators: general idea, structures of JH₂& JH₃. [1L]</p> <p>2.4 Plant growth regulators: structural features and applications of arylacetic acids, gibberellic acids and triacontanol. Synthesis of triacontanol (synthesis of steraryl magnesium bromide and 12-bromo-1-tetrahydropyranyloxydodecane expected) [2L]</p> <p>2.5 Natural Pigments: general structural features, occurrence, biological importance and applications of: carotenoids, anthocyanins, quinones, flavones, pterins & porphyrins (chlorophyll); synthesis of ubiquinone from 3,4,5-trimethoxyacetophenone. [3L]</p>	
Unit III	<p>Heterocyclic Chemistry- I</p> <p>3.1 Introduction & classification of heterocyclic compounds [1L]</p> <p>3.2 Nomenclature of heterocyclic compounds: common, systematic (Hantzsch-Widman) & replacement of 3-6 membered monocyclic compounds [2L]</p> <p>3.3 Synthesis & nucleophilic ring opening reactions of oxiranes, aziridines, oxetanes & azetidines. [4L]</p> <p>3.4 Structure, reactivity, synthesis & reactions of pyrazole, imidazole, oxazole, isoxazole, thiazole, isothiazole. [8L]</p>	15L
Unit IV	<p>Heterocyclic Chemistry- II:</p> <p>4.1 Nomenclature of bicyclic/tricyclic (5-6 membered) fused heterocycles (up to three heteroatoms). [2L]</p> <p>4.2 Structure, reactivity, synthesis & reactions of pyridazines, pyrimidine & pyrazines. [5L]</p> <p>4.3 Structure, reactivity, synthesis and reactions of coumarins, quinoxalines, indole, benzimidazoles, benzoxazoles, benzothiazoles, purines. [8L]</p>	15L



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Standard References:

Unit I

1. Natural Products Chemistry & Applications, Sujata V. Bhat, B.A. Nagasampagi & S. Meenakshi, Narosa Publishing House, 2011
2. Organic Chemistry of Natural Products Volume-II, O.P. Agarwal, Krishna Prakashan, 2011
3. Organic Chemistry, Volume 2, I.L. Finar, ELBS, 6th Edition, Pearson
4. Chemistry of Natural Products, V.K. Ahluwalia, Vishal Publishing Co. 2008

Unit II

5. Natural Products Chemistry & Applications, Sujata V. Bhat, B.A. Nagasampagi & S. Meenakshi, Narosa Publishing House, 2011
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Unit III

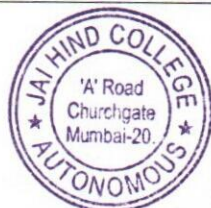
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10. Heterocyclic chemistry, Thomas L. Gilchrist, 3rd Edition, Pearson Education, 2007
11. Heterocyclic Chemistry: Synthesis, Reactions & Mechanisms, R. K. Bansal, Wiley Eastern Ltd., 1990

Unit IV

12. Heterocyclic Chemistry, J.A. Joule & K.Mills, Oxford Blackwell Science, 2000
13. Heterocyclic chemistry, Thomas L. Gilchrist, 3rd Edition, Pearson Education, 2007
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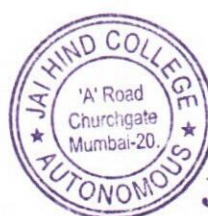
Additional References:

15. Natural product chemistry, A mechanistic, biosynthetic and ecological approach, Kurt B.G. Torssell, Apotekarsocieteten – Swedish Pharmaceutical Press.
16. Chemistry of natural products, F. F. Bentley and F. R. Dollish, 1974
17. Natural Product Chemistry Vol.1 and 2, K. Nakanishi J. Goto. S.Ito Majori and S. Nozoo, Academic Press, 1974.
18. Heterocyclic Chemistry, J. A. Joule and G. F. Smith, ELBS, 2nd edition, 1982.
19. The Conformational Analysis of Heterocyclic Compounds, F.G. Riddell, Academic Press, 1980.
20. Principles of Modern Heterocyclic Chemistry, L.A. Paquette, W.B. Benjamin, Inc., 1978.
21. An Introduction to the Chemistry of Heterocyclic Compounds, 2nd edition, B.M. Acheson, 1975.
22. Natural Products: Chemistry and Biological Significance Interscience, J. Mann, R.S.Davidson, J.B.Hobbs, D.V. Banthrope and J. B. Harborne, Longman, Essex, 1994
23. Stereoselective Synthesis: A Practical Approach, M. Nogradi, Wiley-VCH, 1995.
24. Rodd's Chemistry of Carbon Compounds, Ed. S. Coffey, Elsevier.
25. Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta and A. Marston, Harwood Academic Publishers.
26. Introduction to Flavonoids, B.A. Bohm, Harwood Academic Publishers, 1998.



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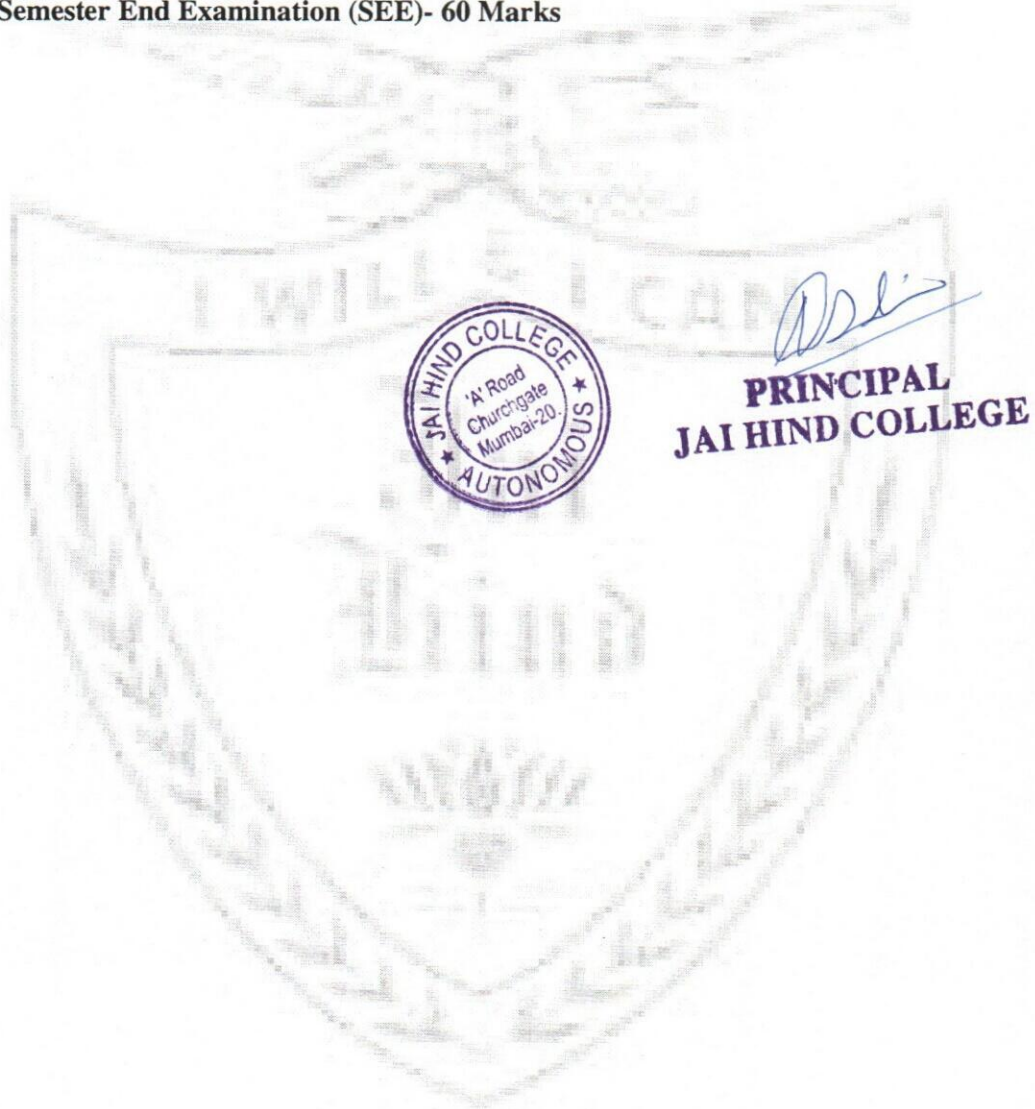
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48. Spectroscopic methods in organic chemistry, Williams and Fleming, Tata McGraw Hill, 4th ed, 1989.
49. Alkaloids, V.K. Ahluwalia, Ane Books Pvt.Ltd.
50. Biotransformations in Organic Chemistry, 5th Edition, Kurt Faber, Springer
51. Structure Determination of Organic Compounds, EPretsch, P. Buhlmann, C.Affolter, Springer




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Evaluation Scheme

- **Continuous Assessment (CA) – 40 Marks**
 - Knowledge and Application based: Objective test of 20 Marks
 - Skill based (20 marks): Learner will be assessed on relevant skills pertaining to the course content of a particular paper which could involve but not limited to
 - Oral Presentations on relevant topics
 - Review writing/Worksheets etc.
- **Semester End Examination (SEE)- 60 Marks**





**JAI HIND COLLEGE
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&**

**J.T.LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)**

"A" Road, Churchgate, Mumbai - 400 020, India.

**Affiliated to
University of Mumbai**

Program: M.Sc. Chemistry
(Organic)

Course: Medicinal Chemistry, Biogenesis and Green

Semester III

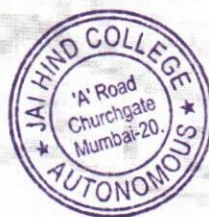
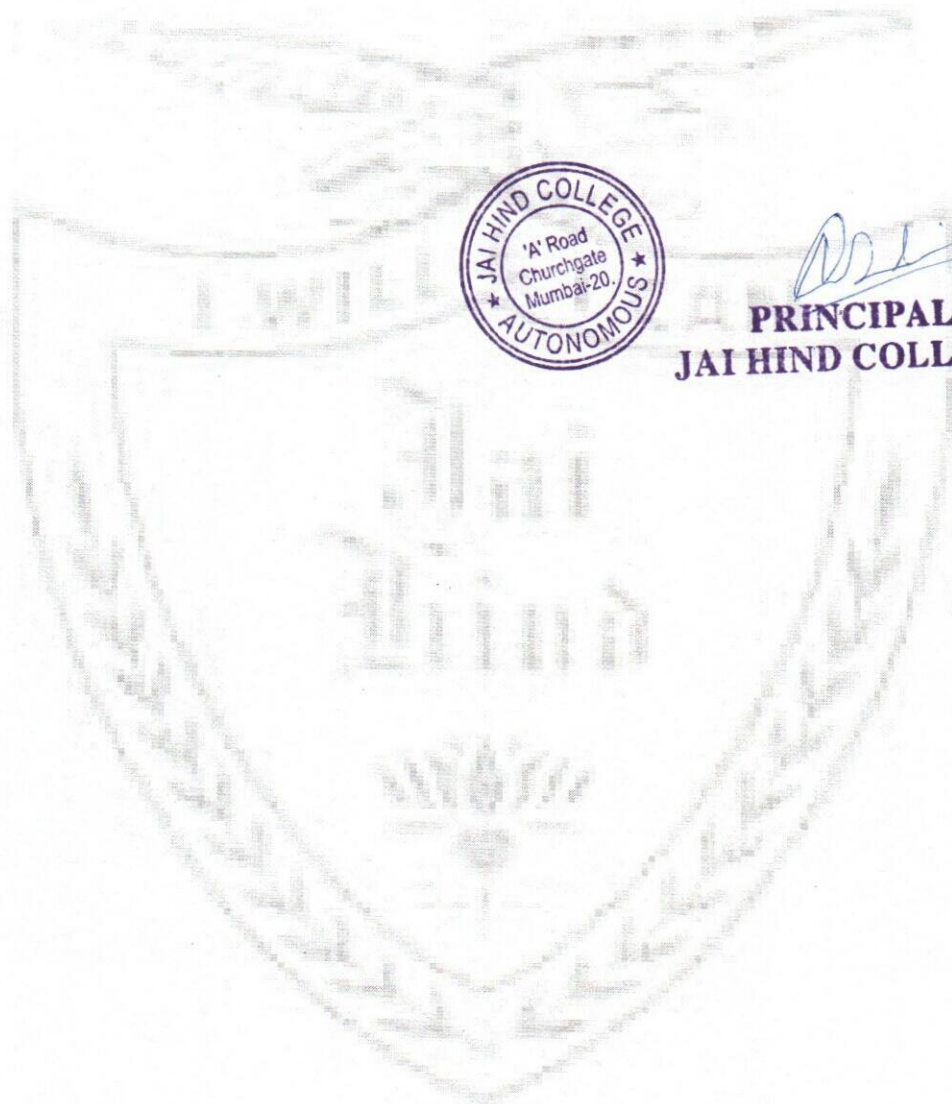
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the academic year 2022-23**




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M.Sc. Medicinal Chemistry, Biogenesis and Green Syllabus

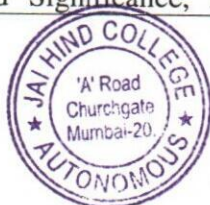
Semester III			
Course Code	Course Title	Credits	Lectures/Week
PSCHE3304	Medicinal Chemistry, Biogenesis and Green	04	04





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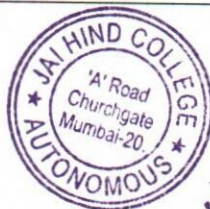
Semester III – Theory

Course: PSCHE3304	Medicinal Chemistry, Biogenesis & Green (Credits: 04 Lectures/Week: 04)	
	Drug discovery, design development; synthesis of drugs, biosynthesis of metabolites, green chemistry	
	Objectives: <ol style="list-style-type: none"> 1. To understand the development and design of drug discovery. 2. To understand the synthetic method of drug. 3. To explain the concept of biosynthesis of metabolites, green chemistry Outcomes: <ol style="list-style-type: none"> 1. To describe the development and design in drug discovery. 2. To discuss the synthetic method of drug. 3. To summarise the concept of biosynthesis of metabolites, green chemistry. 	
Unit I	Drug discovery, design & development <ol style="list-style-type: none"> 1.1. Important terms used in medicinal chemistry- Pharmacophore, Lead, Pharmacodynamics & Pharmacokinetics, receptor, therapeutic index, Half-life, bioavailability, drug assay and drug potency. Agonist & Antagonist [2L] 1.2. ADME, Factors affecting the process – resonance, spatial considerations, inductive effect, solubility, pH, H-bonding, partition coefficient. [4L] 1.3. Metabolic biotransformations: Phase I and Phase II Metabolic reactions with examples [3L] 1.4. Theories of Drug-Receptor interaction: Following theories in detail: Occupation theory, rate theory, Macromolecular perturbation theory, activation – aggregation theory [6L] 	15L
Unit II	Drug discovery, design, development & synthesis <ol style="list-style-type: none"> 2.1. Lead Discovery: Serendipity, Clinical trials, Drug metabolism, CADD, Random screening, non-random screening [2L] 2.2. Lead modification: Identification of the pharmacophore, Functional group modification, Structure activity relationship (2 examples – sulpha drugs & Benzimidazoles), Structure modification to increase potency: Homologation, chain branching, ring-chain transformation, bioisosterism. [4L] 2.3. Quantitative structure activity relationship studies: Historical background and Significance, Hammett Equation, Hansch 	15L




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	<p>Analysis, Collander equation, Taft Equation, Houghton tea-bag Procedure [4L]</p> <p>2.4. Concept of prodrugs and soft drugs. (a) Prodrugs: Types of prodrugs, Design of prodrugs, advantages of prodrug use. (b) Soft drugs: concept and properties. [3L]</p> <p>2.5. Synthesis and application of the following drugs: Fluoxetine, esomeprazole, fluconazole, zidovudine, methotrexate, diclofenac, labetalol, fenofibrate. [2L]</p>	
Unit III	<p>Biogenesis & biosynthesis of natural products</p> <p>3.1 Primary & secondary metabolites & the building blocks, common mechanisms in biological chemistry. [3L]</p> <p>3.2 Acetate pathway: Biosynthesis of malonylCoA, saturated fatty acids, prostaglandins from arachidonic acid, aromatic polyketides. [4L]</p> <p>3.3 Shikimic Acid pathway: Biosynthesis of shikimic acid, aromatic amino acids, cinnamic acid and its derivatives, lignin and lignans, benzoic acid and its derivatives, flavonoids and isofalvonoids. [4L]</p> <p>3.4 Mevalonate pathway: Biosynthesis of mevalonic acid, monoterpenes – geranyl cation and its derivatives, sesquiterpenes – farnesyl cation and its derivatives and diterpenes. [4L]</p>	15L
Unit IV	<p>Green Chemistry:</p> <p>4.1 Introduction, basic principles of green chemistry. Designing a green synthesis: Green starting materials, green reagents, green solvents and reaction conditions, green catalysts.[1L]</p> <p>4.2 Use of the following in green synthesis with suitable examples: [9L]</p> <ol style="list-style-type: none"> Green reagents: dimethylcarbonate; Green catalysts: Acid catalysts, oxidation catalysts, basic catalysts; Green solvents: water, ionic liquids, deep eutectic solvents, supercritical carbon dioxide. Enzyme catalyzed organic reactions: Hydrolysis, hydroxylation, oxidation and reduction. Enzymes in organic synthesis. Fermentation: Production of drugs/drug intermediates by fermentation. Production of chiral hydroxy acids, vitamins, amino acids, β-lactam antibiotics. Synthesis of chemicals via microbial 	15L



	<p>transformation, synthesis of L-ephedrine. Chemical processes with isolated enzymes in free form (hydrocyanation of mphenoxybenzaldehyde) and immobilized form (production of 6- aminopenicillanic acid).</p> <p>4.3 Comparison of traditional processes versus green processes in the syntheses of ibuprofen, adipic acid, 4-aminodiphenylamine, p-bromotoluene and benzimidazole. [3L]</p> <p>4.4 Green Cataysts: Nanocatalyst, Types of nanoctalysts, Advantages and Disadvantages of Nanocatalysts, Idea of Magnetically separable nanocatalysts. [2L]</p>
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Standard References:

Unit I

1. The Organic Chemistry of Drug Design & Drug Action, Richard B. Silverman, 2nd Edition, Academic Press
2. Medicinal Chemistry- William O. Foye
3. Medicinal Chemistry (Vol. I & II)- Burger

Unit II

4. The Organic Chemistry of Drug Design & Drug Action, Richard B. Silverman, 2nd Edition, Academic Press
5. Medicinal Chemistry- William O. Foye
6. Medicinal Chemistry (Vol. I & II)- Burger

Unit III

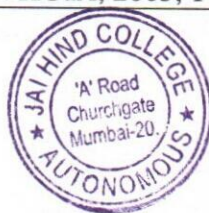
7. The Organic Chemistry of Biological Pathways, John McMurry, Tadhg Begley by Robert and Company publishers.
8. Morrow, Gary W. Bioorganic Synthesis: An Introduction, Oxford University Press, Incorporated, 2016

Unit IV

9. Green Chemistry: An Introductory Text, Mike Lancaster, 2nd Edition, Royal Society of Chemistry.
10. New trends in Green Chemistry, V.K. Ahluwalia & M. Kidwai, 2nd Edition, Anamaya Publishers, New Delhi.

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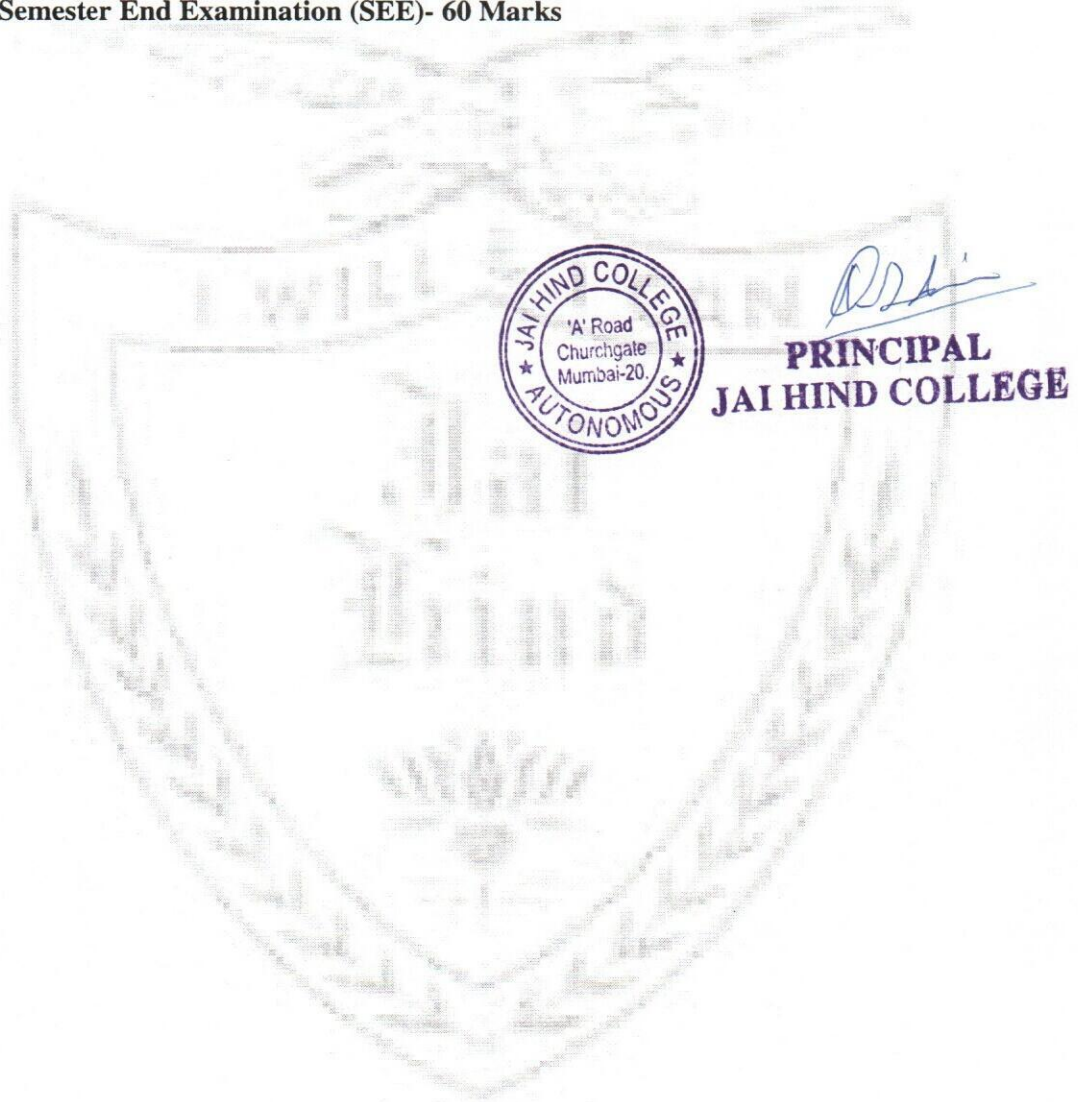
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18. An introduction to drug design-S. S. Pandeya and J. R. Dimmock (New age international)
19. Burger's medicinal chemistry and drug discovery. by Manfred E. Wolf
20. Introduction to Medicinal chemistry. by Graham Patrick
21. T. B. of Organic medicinal and pharmaceutical chemistry-Wilson and Gisvold's (Ed. Robert F. Dorge)
22. An introduction to medicinal chemistry-Graham L. Patrick, OUP Oxford, 2009.
23. Principles of medicinal chemistry (Vol. I and II)-S. S. Kadam, K. R. Mahadik and K.G. Bothara , Nirali prakashan.
24. Strategies for organic drug synthesis and design - D. Lednicer Wiley
25. Pharmacological basis of therapeutics-Goodman and Gilman's (McGraw Hill)
26. Enzyme catalysis in organic synthesis, 3rd edition. Edited by Karlheinz Drauz, Harold Groger, and Oliver May, Wiley-VCH Verlag GmbH & Co KgaA, 2012.
27. Biochemistry, Dr U Satyanarayan and Dr U Chakrapani, Books and Allied (P) Ltd.
28. Bioorganic, Bioinorganic and Supramolecular chemistry, P.S. Kalsi and J.P. Kalsi. New Age International Publishers
29. The Organic Chemistry of Enzyme-Catalysed Reactions, Academic Press, By Richard B. Silverman
30. Enzymes: Practical Introduction to structure, mechanism and data analysis, By Robert A. Copeland, Wiley-VCH, Inc.
31. Bioorganic Chemistry- A practical approach to Enzyme action, H. Dugas and C. Penny. Springer Verlag, 1931
32. Biochemistry: The chemical reactions in living cells, by E. Metzler. Academic Press.
33. Concepts in biotechnology by D. Balasubramanian & others
34. Principals of biochemistry by Horton & others.
35. Bioorganic chemistry - A chemical approach to enzyme action by Herman Dugas and Christopher Penney.
36. Medicinal Natural Products: A Biosynthetic Approach by Paul M. Dewick. 3rd Edition, Wiley.
37. Natural product chemistry, A mechanistic, biosynthetic and ecological approach, Kurt B. G. Torssell, Apotekarsocieteten – Swedish pharmaceutical press.
38. Chemistry of Natural Products, F. F. Bentley and F. R. Dollish, 1974.
39. Natural Product Chemistry Vol.1 and 2, K. Nakanishi J. Goto. S.Ito Majori and S. Nozoo, Academic Press, 1974.
40. Organic synthesis in water. By Paul A. Grieco, Blackie.
41. Green chemistry, Theory and Practical, Paul T. Anastas and John C. Warner.
42. An introduction to green chemistry, V. Kumar, Vishal Publishing Co.
43. Organic synthesis: Special techniques. V.K.Ahulwalia and Renu Aggarwal




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Evaluation Scheme

- **Continuous Assessment (CA) – 40 Marks**
 - Knowledge and Application based: Objective test of 20 Marks
 - Skill based (20 marks): Learner will be assessed on relevant skills pertaining to the course content of a particular paper which could involve but not limited to
 - Oral Presentations on relevant topics
 - Review writing/Worksheets etc.
- **Semester End Examination (SEE)- 60 Marks**





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University of Mumbai**


Program: M.Sc. Chemistry
(Organic)

Course: Separation of Organic Mixture

Semester III

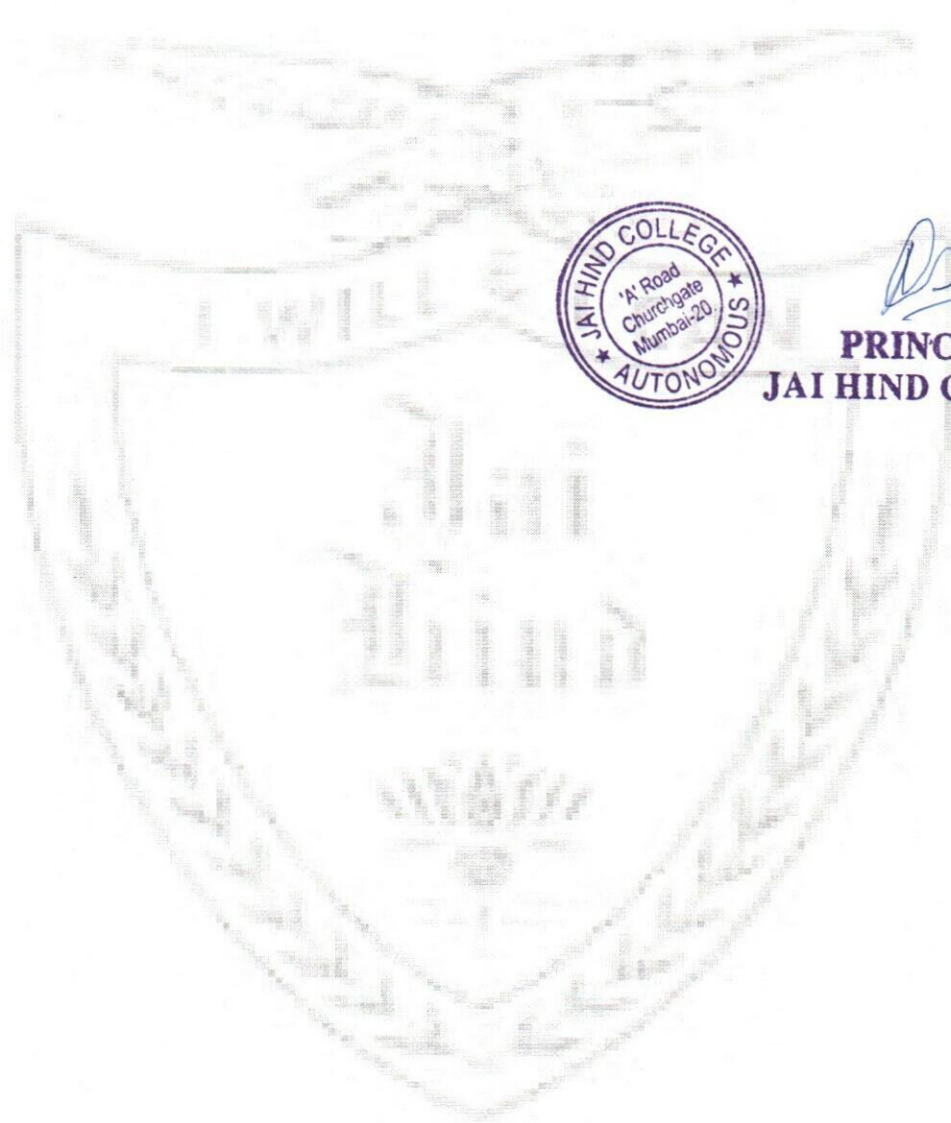
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the academic year 2022-23**




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M.Sc. Separation of Organic Mixture Syllabus

Semester III			
Course Code	Course Title	Credits	Lectures /Week
PSCHEP3301	Separation of Organic Mixture	02	02

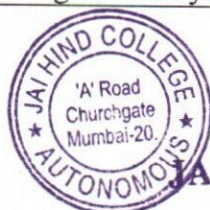


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Semester III – Practical

Course: PSCHEP3301	Separation of Organic Mixture (Credits: 02, Practical /Week: 02) Objectives: 1. To identify the nature of the components of a binary mixture. 2. To separate the components of a binary mixture by chemical/physical method. 3. To purify the components of binary mixture by recrystallization/distillation 4. To identify a component of a binary mixture. Outcomes: 1. To adjudge the method of separation (physical or chemical) for a given mixture of organic compounds. 2. To ascertain the extent of separation based on weights of isolated compounds, physical constants & identification.
	Separation of Organic Mixture & Characterisation of Organic Compounds: 1. Separation of binary mixture using physical and chemical methods. 2. Characterization of both components with the help of chemical analysis and confirmation of the structure with the help of derivative preparation. 3. Purification and determination of mass/volume and physical constant of the two components. The following types are expected: a) Water soluble/water insoluble solid and water insoluble solid, b) Non-volatile liquid and Non-volatile liquid (chemical separation) c) Solid and non-volatile liquid (chemical separation) Minimum three mixtures from each type and a total of ten mixtures are expected. REFERENCES: 1. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis- V.K. Ahluwalia and Renu Aggarwal, Universities Press India Ltd., 2000. 2. Advanced Practical Organic Chemistry – N. K. Vishnoi, Third Addition, Vikas Publishing House PVT Ltd 3. Systematic Laboratory Experiments in Organic Synthesis- A. Sethi, New Age International Publications 4. Systematic Identification of Organic compounds, 6th edition, R. L. Shriner, R. C. Fuson and D.Y. Curtin Wiley, New York 5. Vogel's Textbook of Practical Organic Chemistry, 5 th Edition, B. S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, Pearson Education 6. Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice Hall 7. Macro-scale and Micro-scale Organic Experiments, K. L. Williamson, D. C. Heath 8. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold

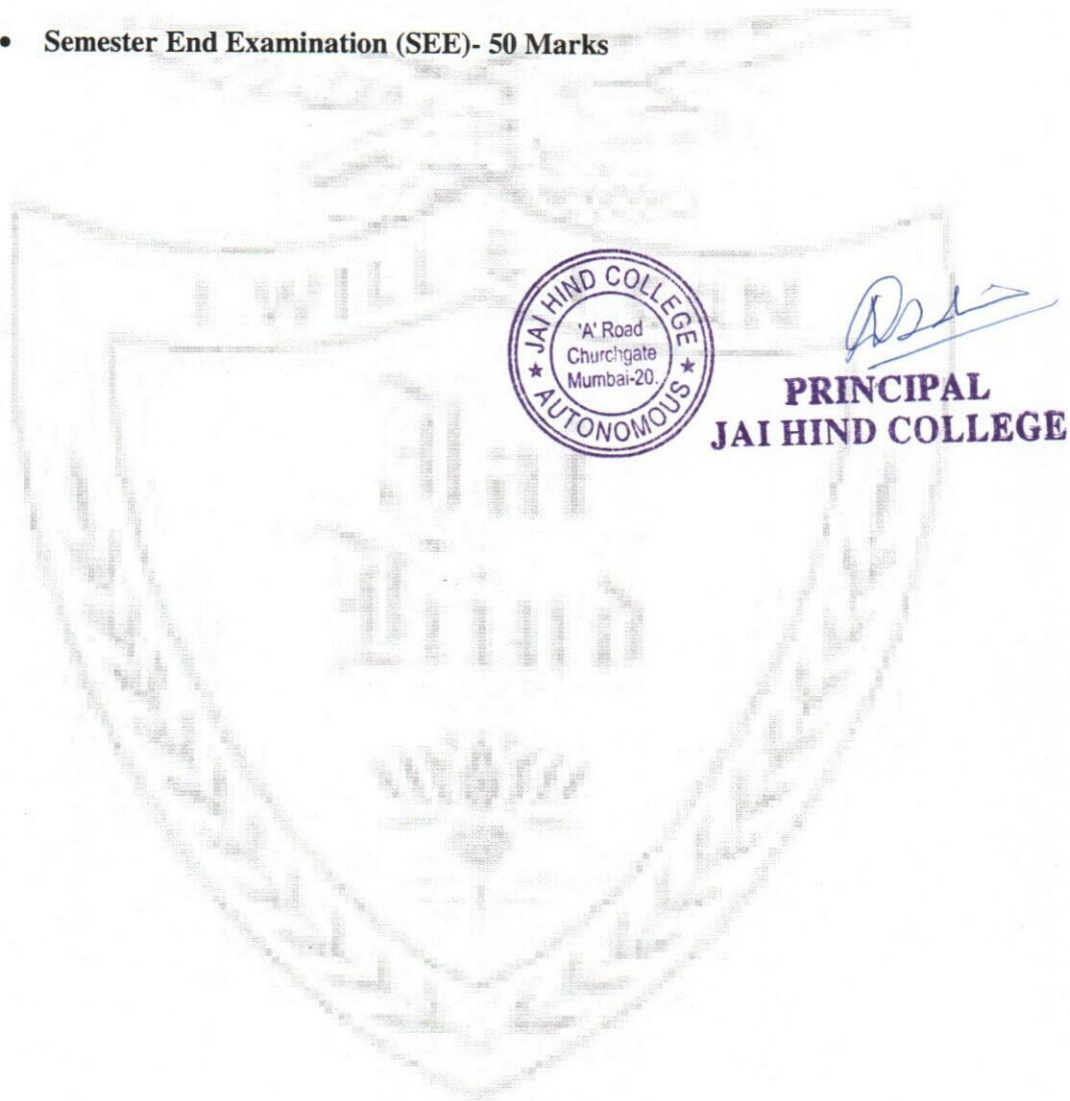


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	<p>9. Handbook of Organic Analysis- Qualitative and Quantitative, H. Clark, Adward Arnold</p> <p>10. Laboratory Manual of Organic Chemistry, Fifth edition, R K Bansal, New Age Publishers</p> <p>11. Organic structures from spectra, L. D. Field, S. Sternhell, John R. Kalman, Wiley, 4th ed., 2011</p>
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Evaluation Scheme

- Semester End Examination (SEE)- 50 Marks





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**Affiliated to
University of Mumbai**

Program: M.Sc. Chemistry
(Organic)

Course: Characterisation of Organic Compounds

Semester III

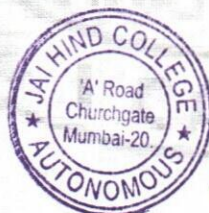
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M.Sc. Characterisation of Organic Compounds Syllabus

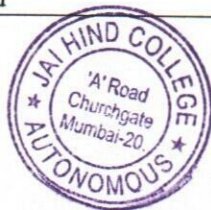
Semester III			
Course Code	Course Title	Credits	Lectures/Week
PSCHEP3302	Characterisation of Organic Compounds	02	02



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Semester III – Practical

Course: PSCHEP3302	Characterisation of Organic Compounds (Credits: 02, Practical /Week: 02) Objectives: <ol style="list-style-type: none">1. To identify the nature of the components of a binary mixture.2. To separate the components of a binary mixture by chemical/physical method.3. To purify the components of binary mixture by recrystallization/distillation4. To identify a component of a binary mixture. Outcomes: <ol style="list-style-type: none">1. To adjudge the method of separation (physical or chemical) for a given mixture of organic compounds.2. To ascertain the extent of separation based on weights of isolated compounds, physical constants & identification. Separation of Organic Mixture & Characterisation of Organic Compounds: <ol style="list-style-type: none">1. Separation of binary mixture using physical and chemical methods.2. Characterization of both components with the help of chemical analysis and confirmation of the structure with the help of derivative preparation.3. Purification and determination of mass/volume and physical constant of the two components. The following types are expected:<ol style="list-style-type: none">a) Water soluble/water insoluble solid and water insoluble solid,b) Non-volatile liquid and Non-volatile liquid (chemical separation)c) Solid and non-volatile liquid (chemical separation) <p>Minimum three mixtures from each type and a total of ten mixtures are expected.</p> <p>REFERENCES:</p> <ol style="list-style-type: none">12. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis- V.K. Ahluwalia and Renu Aggarwal, Universities Press India Ltd., 2000.13. Advanced Practical Organic Chemistry – N. K. Vishnoi, Third Addition, Vikas Publishing House PVT Ltd14. Systematic Laboratory Experiments in Organic Synthesis- A. Sethi, New Age International Publications15. Systematic Identification of Organic compounds, 6th edition, R. L. Shriner, R. C. Fuson and D.Y. Curtin Wiley, New York16. Vogel's Textbook of Practical Organic Chemistry, 5th Edition, B. S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, Pearson Education17. Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice Hall18. Macro-scale and Micro-scale Organic Experiments, K. L. Williamson, D. C. Heath19. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold20. Handbook of Organic Analysis- Qualitative and Quantitative, H. Clark, Adward Arnold
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	<p>21. Laboratory Manual of Organic Chemistry, Fifth edition, R K Bansal, New Age Publishers</p> <p>22. Organic structures from spectra, L. D. Field, S. Sternhell, John R. Kalman, Wiley, 4th ed., 2011</p>
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Evaluation Scheme

- Semester End Examination (SEE)- 50 Marks





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(AUTONOMOUS)**

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Program: M.Sc. Chemistry
(Organic)

Course: Research Methodology

Semester III

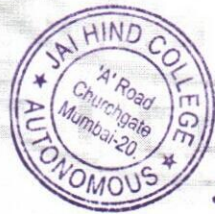
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M.Sc. Research Methodology Syllabus

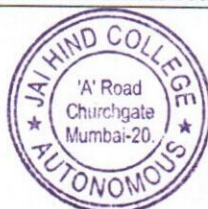
Semester III			
Course Code	Course Title	Credits	Lectures/Week
PSCHEP3303	Research Methodology	02	02




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Semester III – Practical

Course: PSCHEP3303	Research Methodology (Credits: 02, Practical /Week: 02) Objectives: 1. To understand a general definition of research design. 2. To familiar with how to write a good introduction to educational research study and the components that comprise such an introduction. Outcomes: 1. To identify a research problem stated in a study. 2. To distinguish a purpose statement, a research question or hypothesis, and a research objective.
	PSCHEP1303: Research Methodology Unit Ia: Research Methodology: Print: Primary, Secondary and Tertiary sources. Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, textbooks, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples. Digital: Web sources, E-journals, Journal access, TOC alerts, Hot articles, Citation Index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, preprint servers, Search engines, Scirus, Google Scholar, ChemIndustry, Wiki-databases, ChemSpider, Science Direct, SciFinder, Scopus. Information Technology and Library Resources: The Internet and World wide web, Internet resources for Chemistry, finding and citing published information. Unit Ib: Methods of scientific research and writing scientific papers: Reporting practical and project work, writing literature surveys and reviews, organizing a poster display, giving an oral presentation. Writing Scientific Papers: Justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work, writing ethics, avoiding plagiarism. Unit II: Teaching Aptitude: Teaching: Concept, Objectives, Levels of teaching (Memory, Understanding and Reflective), Characteristics and basic requirements. 2. Learner's characteristics: Characteristics of adolescent and adult learners (Academic, Social, Emotional and Cognitive), Individual differences. 3. Factors affecting teaching related to: Teacher, Learner, Support material, Instructional facilities, Learning environment and Institution. 4. Methods of teaching in Institutions of higher learning: Teacher centred vs. Learner centred methods; Off-line vs. On-line methods (Swayam, Swayam Prabha, MOOCs etc.). 5. Teaching Support System: Traditional, Modern and ICT based. 6. Evaluation Systems: Elements and Types of evaluation, Evaluation in Choice Based Credit System in Higher education, Computer based testing, Innovations in evaluation systems. Unit III: Communication: Communication: Meaning, types and characteristics of communication; Effective communication: Verbal and Non-verbal, Inter-Cultural and group communications, Classroom communication; Barriers to effective



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communication; Mass-Media and Society.

Unit IV: Mathematical Reasoning and Aptitude:

1. Types of reasoning. 2. Number series, Letter series, Codes and Relationships.
3. Mathematical Aptitude (Fraction, Time & Distance, Ratio, Proportion and Percentage, Profit and Loss, Interest and Discounting, Averages etc.).

Unit V: Data Interpretation:

1. Sources, acquisition and classification of Data. 2. Quantitative and Qualitative Data. 3. Graphical representation (Bar-chart, Histograms, Pie-chart, Table-chart and Line-chart) and mapping of Data. 4. Data Interpretation

REFERENCES:

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2. Hibbert, D. B. & Gooding, J. J. (2006) Data Analysis for Chemistry Oxford University Press.
3. Topping, J., (1984) Errors of Observation and their Treatment 4 th Ed., Chapman Hill, London.
4. Levie, R. De. (2001) How to use Excel in Analytical Chemistry and in general scientific data analysis Cambridge University Press.

Evaluation Scheme

- Semester End Examination (SEE)- 50 Marks




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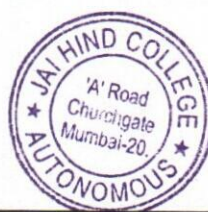
Program: M.Sc. Chemistry

(Organic)

Course: Literature Review

Semester III

**Credit Based Semester and Grading System (CBSGS) with effect from
the academic year 2022-23**




**PRINCIPAL
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M.Sc. Literature Review Syllabus

Semester III			
Course Code	Course Title	Credits	Lectures/Week
PSCHEP3304	Literature Review	02	02



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JAI HIND COLLEGE

Semester III – Practical

Course: PSCHEP3304	Literature Review (Credits: 02, Practicals/Week: 02)
	Objectives: To understanding of the existing research and debates relevant to a particular topic or area of study, and to present that knowledge in the form of a written report. Outcomes: To critically write review and conclude its finding.
	PSCHEP3304: Literature Review Literature survey, review writing and presentation

Evaluation Scheme

- Semester End Examination (SEE)- 50 Marks



[Signature]
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