

GONDWANA UNIVERSITY, GADCHIROLI



Syllabus

for

Bachelor of Science (B.Sc. SEM I & II) Chemistry

Based on NEP – 2020

(with effect from 2024-25)

Board of Studies in Chemistry

Faculty: Science and Technology



Gondwana University, Gadchiroli
NEP 2020 U.G. PROGRAMME SESSION 2024-25

Faculty of Science and Technology

Programme Name - B.Sc. Sem I (CHEMISTRY) (Level 4.5) GUGSTUGCHE Revised Examination Scheme & Basket

Sr. No.	Course Category	Subject Name		Subject Code	Total Credit	Teaching Scheme (Hrs)			Examination Scheme								Total Marks		
						Theory	Practical	Total Hrs.	Theory				Practical						
									UA	CA	Total Mark	Min. Passing	Duration of Exam (Hrs.)	UA	CA	Total Mark		Min. Passing	
1	Core Subject-I	Select any Two core group subject from Annexure-1	i) Subject -I (Basic Inorganic Chemistry)	STUG01 CHE001	02	02	--	02	40	10	50	20	02	--	--	--	--	50	
			ii) Subject II-Major Subject from Science		02	02	-	02	40	10	50	20	02	-	-	-	-	50	
			iii) Practical Based on Subject -I (Basic Inorganic Chemistry)	STUG01 CHE002	02	-	04	04	-	-	-	-	-	30	20	50	25	50	
			iv) Practical Based on Subject -II		02	-	04	04	-	-	-	-	-	30	20	50	25	50	
2	OE	Group-A (Any one from Annexure – II) 1)Chemistry in Daily Life I or		STUG01 CHE003	02	02	--	02	40	10	50	20	02	--	--	--	--	50	
		2) Introduction to Basic Chemistry 3) Daily Life Chemistry 2 4) Environmental Chemistry 1																	
3	VSC	Chemistry Practical Skills – I		STUG01 CHE004	02	--	04	04	--	--	--	--	--	30	20	50	25	50	
4	SEC	Water Treatment - I		STUG01 CHE005	02	02	--	02	40	10	50	20	02	--	--	-	-	50	
5	VEC	Audit Course (Any one from Annexure –V)			02	02	-	02	--	50	50	20	--	--	-	-	-	50	
6	AEC	English/Marathi/Hindi/Bengali/Pali/ Supplementary English, Annexure-VI			02	02	--	02	40	10	50	20	02	--	--	--	--	50	
7	IKS	Generic IKS			02	02	--	02	40	10	50	20	02	--	--	--	--	50	
8	CC	NCC/NSS/Yoga/Sports (Any One)			02	--	04	04	--	--	--	--	--	--	50	50	25	50	
Total						22	14	16	30	240	110	350	140	12	90	110	200	100	550

Abbreviations:**OE : Generic/ Open Electives****SEC:** Skill Enhancement Courses **AEC:** Ability Enhancement Courses:**IKS:** Indian Knowledge System **VEC:** Value Education Courses**OJT:** On Job Training: Internship/ Apprenticeship **FP:** Field: projects,**CEP:** Community engagement and service **CC:** Co-curricular Courses**RM:** Research Methodology **RP:** Research Project**VSEC/VSC:** Vocational Skill and Skill Enhancement Courses

- **Shall be based on Group Subject-I**

Note(s):

- 1) The Students shall undertake total three subjects which shall include one each from Group Subject –I, Group Subject-II and Group Subjects-III.
- 2) From Sem-III onwards out of the above three Subjects, the Students shall select one Subject as a major and one Subject as a minor as per Government letter No.क्र. एनईपी.२०२२/प्र.क्र.०९/विशि-३ शिकाना दिनांक १३ मार्च, २०२४. As per AEC is concerned, those Students Selected English as a AEC in 1st Sem, shall select Marathi/Hindi/Bengali/Pali in the IInd Sem and Vis-a Versa
- 3) As per open elective (OE)is concerned, students shall opt one subject from Group-A and one from Group-B
- 4) Generic IKS will be common for all Faculties in the first Semester as per Government letter No. क्र. एनईपी.२०२२/प्र.क्र.०९/विशि-३(शिकाना) दिनांक २५ जानेवारी, २०२४.
- 5) VSC Shall be based on Group Subject.

Gondwana University, Gadchiroli.
NEP 2020 U.G. PROGRAMME (FROM SESSION 2024-25)
Faculty Name :Science and Technology
Programme Name: UG Chemistry

Syllabus - NEP

B.Sc. Semester – I

Core – I Chemistry – I (Basic Inorganic Chemistry)

Credits : - = 02 30 hrs Marks : - Theory = 50 (40 + 10)

Unit – 1 [10 hrs]

A) Atomic Structure

Review of Bohr's Theory and its Limitations, Idea of de-Broglie matter waves, Heisenberg's uncertainty principle, Schrodinger wave equation, significance of Ψ and Ψ^2 , quantum numbers, radial and angular wave functions and probability distribution curves, atomic orbital, shapes of s, p and d-orbital, Aufbau and Pauli's exclusion principle, Hund's multiplicity rule, electronic configuration of the elements and ions. [5 L]

B) Periodic Properties

Atomic and ionic radii, ionization energy, electron affinity and electronegativity - definition, trends in periodic table and applications in predicting and explaining the chemical behaviour, factors affecting ionization potential. Pauling's and Mulliken's scales of electronegativity, effective nuclear charge and Slater's rules with some exercise. [5 L]

Unit – 2 [10 hrs]

(A) Covalent Bond: Valence bond theory and its limitations, directional of covalent bond, overlap criteria of bond strength, Bond energy, bond length, bond order and bond angle. Various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH_3 , H_3O^+ , SF_4 , ClF_3 , ICl_3 and H_2O . [5 L]

(B) Molecular Orbital Theory: LCAO approximation, wave equation for molecular orbitals, difference between bonding and antibonding MOs in terms of energy and electron density distribution curves, order of energy levels in MOs. MO diagrams for homonuclear diatomic molecules of hydrogen, helium and second row of periodic table. Concept of non-bonding MOs in HF molecule, Coulson's MO diagram of CO and NO. [5 L]

Unit 3 [10 hrs]

(A) s – Block Elements Comparative study of s – block elements with respect to: i) Atomic & ionic radii, ii) Ionisation Energy iii) Electron Affinity iv) Electronegativity v) Reducing property. Diagonal relationship between Li & Mg, Salient features of hydrides, Solvation and Complexation tendencies including their functions in biosystems. [5 L]

(B) p-Block Elements: Comparative study of p – block elements with respect to: i) Atomic & ionic radii, ii) Ionisation Energy iii) Electron Affinity iv) Electronegativity v) Oxidation State. Diagonal relationship between Be & Al, Preparation, properties and structure of hydrides of 5 th group elements. Nature and bonding in phosphorous trioxides (P_2O_3), phosphorous pentaoxide (P_2O_5) and oxyacids of phosphorous.(5L)

Question Paper Pattern Subject I

Time: 2 Hrs Maximum Marks: 40

Instructions to Candidates:

1. All sections/parts are compulsory.
2. Labelled diagrams/Chemical Reactions wherever necessary.
3. There will be five descriptive questions, each carrying 8 marks.

Ques. I. A) B) two Long Question Unit 1 ($5 \times 2 = 10$)

OR

A) B) C) D) Four Question ($2.5 \times 4 = 10$)

Qu. 2. Long Question Unit II ($5 \times 2 = 10$)

OR

A) B) C) D) Four Question ($2.5 \times 4 = 10$)

Qu. 3. Long Question Unit III (5x2= 10)

OR

A) B) C) D) Four Question (2.5x4 = 10)

Qu.4. Answer any ten of the following twelve Short Question (1x10 = 10)

2) Basic Inorganic Chemistry Practical

Credits : - Practical = 02 60 hrs Marks = 50 (30 + 20)

I) Volumetric Analysis

- 1) Preparation of standard solution by weighing and Preparation of 0.001 M solution from 0.1M solution by dilution.
- 2) Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
- 3) Determination of commercial vinegar acetic acid in using NaOH
- 4) Estimation of oxalic acid by titrating it with KMnO₄.
- 6) Determination of zinc by complexometric titration with EDTA.
- 7) Determination of Total, Permanent and Temporary Hardness of given Water Sample by complexometric titration with EDTA.

Distribution of Marks - Total Marks – 30

Duration: - 4 hrs

1) Any two experiments of 10 marks each	20
2) Viva Voce of 5 marks	05
3) Record Completion 5 marks	05
Total	30

Practical Internal 20 marks

1) practical attendance	15
2) Practical writing regularity and Check	05
Total	20

3) Open Elective (OE) – Group A. Chemistry in Daily life

Credits : - Theory = 02 30 hrs Marks : - Theory = 50 (40 + 10)

Unit – I [15 hrs]

Primary need of water, the fundamental substance of life carbohydrates, proteins, lipids, nucleic acid, vitamins, minerals, and hormones- sources, applications, and diseases due to deficiency.

Unit – II [15 hrs]

Drug classification, importance of in drugs, the uses and side-effects of different classes of drugs: analgesic, antipyretics, tranquilizers, antiseptics, disinfectants antimicrobials and antibiotics, antacids, antihistamines, food preservatives, and artificial sweeteners.

Question Paper Pattern

Ques. 1. A) B) Two Long answer questions from unit I (2 x 10 = 20 Marks)

Or

Ques. 1 C) D) E) F) Four Questions From unit I (4 x 5 = 20)

Ques. 2. A) B) Two Long answer questions from unit II (2 x 10 = 20 Marks)

Or

Ques. 2 C) D) E) F) Four Questions From unit II (4 x 5 = 20)

4) Open Elective (OE) – Group B. Introduction to Basic Chemistry

Credits : - Theory = 02 30 hrs Marks : - Theory = 50 (40 + 10)

Unit – I [15 hrs]

Atoms – the building blocks of matter, composition or structure of atoms, atomic number, mass number and isotopes, the periodic table, building molecules.

Unit – II [15 hrs]

types of bonding: covalent, ionic, metallic, and weak (hydrogen and Vander Waals). The states of matter: Solid, liquid, and gases.

5) Open Elective (OE) – Group. Daily Life Chemistry 2

Credits : - Theory = 02 30 hrs Marks : - Theory = 50 (40 + 10)

Unit I:

Dairy Products

[15]

Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, estimation of methyl alcohol in alcoholic beverages.

Unit II:

Food additives, adulterants and contaminants

[15]

Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, sodium cyclamate. Flavours: Vanillin, alkyl esters, monosodium glutamate. Food colorants: Coal tar dyes, non-permitted colours, metallic salts. Analysis of pesticide residues in food.

6) Open Elective (OE) – Group. Environmental Chemistry 1

Credits : - Theory = 02 30 hrs Marks : - Theory = 50 (40 + 10)

Unit I:

[15]

Air Pollution: Air pollutants, prevention and control, Greenhouse gases, acid rain. Ozone hole and CFC's. Photochemical smog and PAN. Catalytic converters for automobile. Bhopal gas tragedy. Hydrologic cycle, sources, criteria and standards of water quality-safe drinking water. Health significance and measurement of water quality parameters, Water purification.

Unit II:

[15]

Toxic chemicals in the environment

pollution aspects, eutrophication. Pesticides and insecticides-pollution aspects. Heavy metal pollution. Solid pollutants- treatment and disposal. Treatment of industrial wastes, Sewage and industrial effluent treatment.

7) Vocational Skill Course (VSC) – Practical – I, Inorganic Practical Skills - I

Credits : - Practical = 02 60 hrs Marks = 50 (30 + 20)

- 1) Separation of mixtures by Chromatography: Measure the R_f value in each case (Combination of two compounds to be given)
- 2) Determination of heat capacity of calorimeter for different volumes
- 3) Determination of enthalpy of (neutralization, ionization, solution of salts, hydration)
- 4) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
- 6) To determine relative coefficient of viscosity of the given liquid by Ostwald viscometer.
- 7) To determine surface tension of liquid by stalagmometer.

Distribution of Marks - Total Marks – 30

Duration: - 4 hrs

1) Any two experiments of 10 marks each	20
2) Viva Voce of 5 marks	05
3) Record Completion 5 marks	05
Total	30

Practical Internal 20 marks

1) practical attendance	15
2) Practical writing regularity and Check	05
Total	20

8) Skill Enhancement Course (SEC) – Water Treatment - I

Credits : - 02 30 hrs Marks : - Theory = 50 (40 + 10)

Water Treatment :

Unit - I) Water Treatment for Industrial Applications: Brief introduction regarding sources, impurities in water, hardness of water and their types. [15 hrs]

Unit – II) Softening of water using lime-soda process: principles in hot and cold lime-soda process. Zeolite softener, demineralization by synthetic ion exchange resins. [15 hrs]

Question Paper Pattern

Ques. 1. A) B) Two Long answer questions from unit I (2 x 10 = 20 Marks)

Or

Ques. 1 C) D) E) F) Four Questions From unit I (4 x 5 = 20)

Ques. 2. A) B) Two Long answer questions from unit II (2 x 10 = 20 Marks)

Or

Ques. 2 C) D) E) F) Four Questions From unit II (4 x 5 = 20)

Reference Books Recommended (Common for Semester – I and Semester – II)

- Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
- Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
- McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
- Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000.
- Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
- Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
- McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
- Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
- Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
- Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
- Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
- Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
- Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).
- Principles of Inorganic Chemistry by Puri. Sharma and Kalia – S. Naginchand & Co. Delhi. 14
- Text book of Inorganic Chemistry by A. K. De. Wiley East Ltd.
- Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan – S. Chand and Co.
- Modern Inorganic Chemistry by R. C. Agrawal, Kitab Mahal.

- Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
- Concise Inorganic Chemistry by J. D. Lee, ELBS.
- Inorganic Chemistry by J. E. Hoheey – Harper and Row.
- Fundamental concepts of Inorganic Chemistry by E. S. Gilreath, McGraw Hill book Co.
- Modern Inorganic Chemistry by W. L. Jolly, McGraw Hill Int.
- Chemistry Facts, Patterns and Principles by Kneen, Rogers and Simpson, ELBS.
- Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
- Inorganic complex compounds by Murmann, Chapman and Hall.
- Text book of Inorganic Chemistry by K. N. Upadhyaya, Vikas Publishing House, Delhi.
- Advanced Practical Inorganic Chemistry by Gurdeep Raj. Goel Publishing House, Meerut.
- Co-Ordination Chemistry by D. Banerjee, TMH Publication.
- Text book of Inorganic Chemistry by Marathe, Bhadange, Mopari and Kubade.
- Organic Chemistry by R. T. Morrison and R. T. Boyd, 6th edition, PHI.
- Organic Chemistry by Pine, 5th edition.
- Inorganic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor – Willey Eastern.
- Organic Chemistry by S. K. Ghosh.
- Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
- Spectroscopy of Organic Compounds by P. S. Kalsi.
- Stereochemistry and Mechanism through solved problems by P.S. Kalsi.
- Organic Chemistry by TWG Solomons, 4th edition, John Wiley.
- Hand book of Organic Analysis by H. J. Clarke, Arnold Heinmen.
- Text book of Practical Organic Chemistry by A. I. Vogel.
- Text book of Organic Chemistry by Jamode, Ganar, Makode, Waghmare, Mahaja, Toshinwal.
- Text book of Organic Chemistry by P.S. Kalsi published by Macmillian India Ltd. 1999 Delhi.
- Comparative Practical Organic Chemistry (Qualitative Analysis) by V. K. Ahluwalia and Sunita Dhingra, Orient Longman.
- Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal. Orient Longman.
- Physical Chemistry : Walter J. Moore, 5th edn. New Delhi.
- Physical Chemistry : G. M. Barrow, McGraw Hill, Indian Edn.
- Principle of Physical Chemistry : Maron and Prutton. 15
- Principles of Physical Chemistry : Puri and Sharma
- Physical Chemistry : P. W. Atkins, 4th Edn.
- Text book of Physical Chemistry : P. L. Sony O. R. Dhrma.
- A Text Book of Chemistry, Inorganic Chemistry, B.Sc. Sem – VI, Rajni Prakashan, Nagpur, by Dr. Niren E. Kathale.
- Physical Chemistry : Levine • Practical Physical Chemistry : Palit and De.
- Practical Physical Chemistry : Yadao • Practical Physical Chemical : Khosla.
- Laboratory Mannual of Physical Chemistry : W. J. Popiel
- Chemistry for Degree Student, Dr. R.L. Madan, S.Chand and Co. New Delhi.
- F.Y. B.Sc. Inorganic Chemistry : Semester-I by Dr. S.B. Rewatkar, Dr. E.L.Ramteke, Y.P. Thawari & S.M.Sontakke – Shell Publication, Nagpur.
- F.Y. B.Sc. Organic Chemistry : Semester-II by Y.P.Thawari, S.M.Sontakke, Dr. S.B. Rewatkar, T.D. Kose, – Shell Publication, Nagpur.
- F.Y. B.Sc. Physical Chemistry : Semester-II by T.D.Kose, Dr. S.B. Rewatkar, S.M.Sontakke, Y.P.Thawari, – Shell Publication, Nagpur.
- F.Y. B.Sc. Practical Chemistry : Semester-I by Dr.S.B. Rewatkar, Dr. E.L.Ramteke, Dr.K.R. Lanjewar, Y.P.Thawari, – Shell Publication, Nagpur.
- Inorganic Chemistry B. Sc. Part I, Sem-I, Rajni Prakashan, Nagpur, by Dr. N.E. Kathale, S. V.Madhamshettiwar, Dr. D. B. Patil.
- Physical Chemistry B. Sc. Part I, Sem-II, Rajni Prakashan, Nagpur, by Dr. N.E. Kathale, S. V. Madhamshettiwar, Dr. D. B. Patil.
- A Textbook of Chemistry, Inorganic Chemistry, Sem – III, Rajni Prakashan, Nagpur, By Dr. Niren E. Kathale.

- A Textbook of Chemistry, Physical Chemistry, Sem – III, Rajni Prakashan, Nagpur, By Dr. Niren E. Kathale.
- A Textbook of Chemistry, Inorganic Chemistry, Sem – V, Rajni Prakashan, Nagpur, By Dr. Niren E. Kathale.
- A Textbook of Chemistry, Organic Chemistry, Sem – V, Rajni Prakashan, Nagpur, By Dr. Niren E. Kathale.

Reference Books for Practicals:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
5. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
6. Handbook of Practical Chemistry, Rajni Prakashan, Nagpur, Sem – I & II, by Dr. N.E. Kathale, V.D. Khanke/Giratkar.
7. Handbook of Practical Chemistry, Rajni Prakashan, Nagpur, Sem – III & IV, by Dr. N.E. Kathale, V.D. Khanke/Giratkar.
8. Handbook of Practical Chemistry, Rajni Prakashan, Nagpur, Sem – V & VI, by Dr. N.E. Kathale, V.D. Khanke/Giratkar.
9. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
10. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011)

Chairman, BOS, Chemistry



Gondwana University, Gadchiroli
NEP 2020 U.G. PROGRAMME SESSION 2024-25

Faculty of Science and Technology

Programme Name - B.Sc. Sem II (CHEMISTRY) (Level 4.5) GUGSTUGCHE Revised Examination Scheme & Basket

Sr. No.	Course Category	Subject Name		Subject Code	Total Credit	Teaching Scheme (Hrs)			Examination Scheme								Total Marks		
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									UA	CA	Total Mark	Min. Passing	Duration of Exam (Hrs.)	UA	CA	Total Mark		Min. Passing	
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			ii) Subject II-Major Subject from Science		02	02	-	02	40	10	50	20	02	-	-	-	-	50	
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2	OE	Group-A (Any one from Annexure – VIII) 1) Chemistry of Drugs I or 2) Material Chemistry II		STUG02 CHE003	02	02	--	02	40	10	50	20	02	--	--	--	--	50	
		Group-B 2. 2) Chemistry of Drugs II 4) Environmental Chemistry II																	
3	VSC	Organic Practical Skills – II		STUG02 CHE004	02	--	04	04	--	--	--	--	--	30	20	50	25	50	
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- 5) VSC Shall be based on Group Subject.

Syllabus - NEP

B.Sc. Semester – II

1) Core Subject I – Chemistry – II (Basic Organic Chemistry)

Credits : - Theory = 02 30 hrs Marks : - Theory = 50 (40 + 10)

Unit – 1 [10 hrs]

Fundamentals of Organic Chemistry Physical Effects, Electronic Displacements: Definition, examples and applications of Inductive Effect, Electromeric Effect, Resonance and Hyper conjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Structure, shape and reactivity of organic molecules: Hybridization in organic molecules (sp , sp^2 , sp^3), bond length, bond angles, bond energies. Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.

Types of Reactions : (In brief with suitable example of each), a) Addition, b) Elimination c) Substitution d) Rearrangement reactions.

Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values.

Unit – II [10 hrs]

Stereochemistry

(A) Basic concept of Isomerism their Type (Structural chain, position, functional group and stereoisomerism) Interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations.

(B) Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis – trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems), Conformations with respect to ethane, butane and cyclohexane. Racemisation, resolution and its methods, inversion and retention of configuration, Asymmetric synthesis.

Unit -III [10 hrs]

Aliphatic Hydrocarbons:

Alkane: Nomenclature laboratory methods of preparation by Wurtz reaction, Kolbes reaction and decarboxylation of carboxylic acid, Industrial methods of preparations. Physical properties, reactions of alkanes. Combustion, cracking, LPG, CNG, Cetan number, Octane Numbers, Free radical mechanism of halogenations of methane.

Cycloalkanes: Nomenclature, Method of formation (3-6 membered rings), a) Freund's method, b) Dickmann's method. Chemical reactions of cycloalkanes: Oxidation, Aromatization and Chlorination. Baeyer's strain theory, theory of strainless rings.

Alkenes: Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

Diene: Nomenclature and classification, Method of formation and Chemical reactions 1-2 and 1-4 additions and Diels-Alder reaction of Conjugated dienes.

Alkynes: Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$.

Question Paper Pattern Subject I

Time: 2 Hrs Maximum Marks: 40

Instructions to Candidates:

1. All sections/parts are compulsory.
2. Labelled diagrams/Chemical Reactions wherever necessary.
3. There will be five descriptive questions, each carrying 8 marks.

Ques. I. A) B) two Long Question Unit 1 (5x2= 10)

OR

A) B) C) D) Four Question (2.5x4 = 10)

Qu. 2. Long Question Unit II (5x2= 10)

OR

A) B) C) D) Four Question (2.5x4 = 10)

Qu. 3. Long Question Unit III (5x2= 10)

OR

A) B) C) D) Four Question (2.5x4 = 10)

Qu.4. Answer any ten of the following twelve Short Question (1x10 = 10)

2) Basic Organic Practical

Credits : - Practical = 02 60 hrs Marks = 50 (30 + 20)

- 1) Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing up to two Extra elements).
- 2) Systematic Qualitative Organic Analysis of Organic Compounds possessing mono functional groups (- COOH, phenolic, aldehydic, ketonic, amide, nitro, amines).
- 3) Determination of M.P. of Organic Compound.

Distribution of Marks - Total Marks – 30

Duration: - 4 hrs

1) Any two experiments of 10 marks each	20
2) Viva Voce of 5 marks	05
3) Record Completion 5 marks	05
Total	30

Practical Internal 20 marks

1) practical attendance	15
2) Practical writing regularity and Check	05
Total	20

3) Open Elective (OE) – Group A) Chemistry of Drugs I

Credits : - Theory = 02 30 hrs Marks : - Theory = 50 (40 + 10)

Unit – I [15 hrs]

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, Ibuprofen);

Unit – II [15 hrs]

Antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir).

4) Open Elective (OE) – Group B) Chemistry of Drugs II

Credits : - Theory = 02 30 hrs

Marks : - Theory = 50 (40 + 10)

Unit – I [15 hrs]

Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glycerol trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine). Fermentation Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid,

Unit II [15 hrs]

1. Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin,
2. Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

5) Open Elective (OE) – Group A) Environmental Chemistry II

Credits : - Theory = 02 30 hrs

Marks : - Theory = 50 (40 + 10)

Unit I: [15]

Soil, water and air pollution:

Soil, water and air pollution problems associated with agriculture, nature and extent. Nature and sources of pollutants – agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc.; air, water and soil pollutants - CPC standards and effect on plants, animals and human beings. Sewage and industrial effluents – composition, effect on soil properties/health, and plant and human beings.

Unit II: [15]

Pesticides and toxic elements

Pesticides – classification, behavior in soil, effect on soil microorganisms. Toxic elements – sources, behavior in soils, effect on nutrients availability, plant and human health. Pollution of water resources -leaching of nutrients and pesticides from soil; greenhouse gases – carbon dioxide, methane and nitrous oxide. Remediation/amelioration of contaminated soil and water.

6) Open Elective (OE) – Group A) Material Chemistry II

Credits : - Theory = 02 30 hrs

Marks : - Theory = 50 (40 + 10)

Unit I: [15]

Surface Coatings:

Classification, objectives of coating surfaces, preliminary treatment of surface. Paints and pigments-formulation, composition, related properties. Oil paint, modified oils, pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly, Plastic paint), Dyes, Wax polish, Water and Oil paints, additives,

Unit II: [15]

Alloys:

Classification, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel and surface treatment. Composition and properties of different types of steels.

Question Paper Pattern

Ques. 1. A) B) Two Long answer questions from unit I (2 x 10 = 20 Marks)

Or

Ques. 1 C) D) E) F) Four Questions From unit I (4 x 5 = 20)

Ques. 2. A) B) Two Long answer questions from unit II (2 x 10 = 20 Marks)

Or

Ques. 2 C) D) E) F) Four Questions From unit II (4 x 5 = 20)

5) Vocational Skill Course (VSC) – Organic Chemistry Practical Skill - III

Credits : - Practical = 02 60 hrs Marks : - 50 (30 + 20)

ORGANIC PREPARATION Mechanism of various reactions involved to be discussed. Recrystallisation, and determination of melting point and calculation of quantitative yields.

- Preparation of acetanilide (Acetylation of Aniline)
 - Preparation of Benzanilide (Benzoylation of Aniline)
 - Preparation of Iodoform from ethanol or Acetone.
 - Preparation of tri-Bromoaniline from Aniline (Bromination)
 - Preparation of Benzoic acid from Benzamide (Hydrolysis)
 - Preparation of Benzoic acid from Benzaldehyde (oxidation)
 - Preparation of Semicarbazone from Acetone.
 - Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone
- [60 hrs]

Distribution of Marks - Total Marks – 30

Duration: - 4 hrs

1) Any two experiments of 10 marks each	20
2) Viva Voce of 5 marks	05
3) Record Completion 5 marks	05
Total	30

Practical Internal 20 marks

1) practical attendance	15
2) Practical writing regularity and Check	05
Total	20

6) Skill Enhancement Course (SEC) – Chemistry of Boiler Troubles - IV

Credits : - Theory = 02 30 hrs Marks = 50 (40 + 10)

Unit – I Boiler troubles: Carryover, Priming and Foaming, Scales and Sludges, Caustic Embrittlement, Boiler Corrosion and its Causes {15 hrs}

Unit – II Boiler Corrosion and effects on boiler operation and methods of prevention. External and Internal conditioning : Phosphate, Carbonate and Calgon conditioning.[15hrs]

Reference Books Recommended (Common for Semester – I and Semester – II)

- Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.

- Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
- McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
- Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000.
- Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
- Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
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- Barrow, G.M. Physical Chemistry Tata McGraw-Hill (2007).
- Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
- Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).
- Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
- Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985).
- Principles of Inorganic Chemistry by Puri. Sharma and Kalia – S. Naginchand & Co. Delhi. 14
- Text book of Inorganic Chemistry by A. K. De. Wiley East Ltd.
- Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan – S. Chand and Co.
- Modern Inorganic Chemistry by R. C. Agrawal, Kitab Mahal.
- Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
- Concise Inorganic Chemistry by J. D. Lee, ELBS.
- Inorganic Chemistry by J. E. Hoheey – Harper and Row.
- Fundamental concepts of Inorganic Chemistry by E. S. Gilreath, McGraw Hill book Co.
- Modern Inorganic Chemistry by W. L. Jolly, McGraw Hill Int.
- Chemistry Facts, Patterns and Principles by Kneen, Rogers and Simpson, ELBS.
- Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
- Inorganic complex compounds by Murmann, Chapman and Hall.
- Text book of Inorganic Chemistry by K. N. Upadhyaya, Vikas Publishing House, Delhi.
- Advanced Practical Inorganic Chemistry by Gurdeep Raj. Goel Publishing House, Meerut.
- Co-Ordination Chemistry by D. Banerjee, TMH Publication.
- Text book of Inorganic Chemistry by Marathe, Bhadange, Mopari and Kubade.
- Engineering Chemistry by S.S. Dara, S Chand & Publication.
- Organic Chemistry by R. T. Morrison and R. T. Boyd, 6th edition, PHI.
- Organic Chemistry by Pine, 5th edition.
- Inorganic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor – Willey Eastern.
- Organic Chemistry by S. K. Ghosh.
- Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
- Spectroscopy of Organic Compounds by P. S. Kalsi.
- Stereochemistry and Mechanism through solved problems by P.S. Kalsi.

- Organic Chemistry by TWG Solomons, 4th edition, John Wiley.
- Hand book of Organic Analysis by H. J. Clarke, Arnold Heinmen.
- Text book of Practical Organic Chemistry by A. I. Vogel.
- Text book of Organic Chemistry by Jamode, Ganar, Makode, Waghmare, Mahaja, Toshinwal.
- Text book of Organic Chemistry by P.S. Kalsi published by Macmillian India Ltd. 1999 Delhi.
- Comparative Practical Organic Chemistry (Qualitative Analysis) by V. K. Ahluwalia and Sunita Dhingra, Orient Longman.
- Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal. Orient Longman.
- Physical Chemistry : Walter J. Moore, 5th edn. New Delhi.
- Physical Chemistry : G. M. Barrow, McGraw Hill, Indian Edn.
- Principle of Physical Chemistry : Maron and Prutton. 15
- Principles of Physical Chemistry : Puri and Sharma
- Physical Chemistry : P. W. Atkins, 4th Edn.
- Text book of Physical Chemistry : P. L. Sony O. R. Dhurma.
- A Text Book of Chemistry, Inorganic Chemistry, B.Sc. Sem – VI, Rajni Prakashan, Nagpur, by Dr. Niren E. Kathale.
- Physical Chemistry : Levine • Practical Physical Chemistry : Palit and De.
- Practical Physical Chemistry : Yadao • Practical Physical Chemical : Khosla.
- Laboratory Mannual of Physical Chemistry : W. J. Popiel
- Chemistry for Degree Student, Dr. R.L. Madan, S.Chand and Co. New Delhi.
- F.Y. B.Sc. Physical Chemistry : Semester-II by T.D.Kose, Dr. S.B. Rewatkar, S.M.Sontakke, Y.P.Thawari, – Shell Publication, Nagpur.
- F.Y. B.Sc. Practical Chemistry : Semester-I by Dr.S.B. Rewatkar, Dr. E.L.Ramteke, Dr.K.R. Lanjewar, Y.P.Thawari, – Shell Publication, Nagpur.
- Inorganic Chemistry B. Sc. Part I, Sem-I, Rajni Prakashan, Nagpur, by Dr. N.E. Kathale, S. V.Madhamshettiwar, Dr. D. B. Patil.
- Physical Chemistry B. Sc. Part I, Sem-II, Rajni Prakashan, Nagpur, by Dr. N.E. Kathale, S. V. Madhamshettiwar, Dr. D. B. Patil.
- A Textbook of Chemistry, Inorganic Chemistry, Sem – III, Rajni Prakashan, Nagpur, By Dr. Niren E. Kathale.
- A Textbook of Chemistry, Physical Chemistry, Sem – III, Rajni Prakashan, Nagpur, By Dr. Niren E. Kathale.
- A Textbook of Chemistry, Inorganic Chemistry, Sem – V, Rajni Prakashan, Nagpur, By Dr. Niren E. Kathale.
- A Textbook of Chemistry, Organic Chemistry, Sem – V, Rajni Prakashan, Nagpur, By Dr. Niren E. Kathale.

Reference Books for Practicals:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
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6. Handbook of Practical Chemistry, Rajni Prakashan, Nagpur, Sem – I & II, by Dr. N.E. Kathale, V.D. Khanke/Giratkar.
7. Handbook of Practical Chemistry, Rajni Prakashan, Nagpur, Sem – III & IV, by Dr. N.E. Kathale, V.D. Khanke/Giratkar.

8. Handbook of Practical Chemistry, Rajni Prakashan, Nagpur, Sem – V & VI, by Dr. N.E. Kathale, V.D. Khanke/Giratkar.
9. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
10. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011)