

Bhavan's Sheth R. A. College of Science, Ahmedabad-1
Allotment of Topics
B.Sc. Sem- V (Chemistry)

CHE-301 (Organic Chemistry)		
UNIT	TOPIC NAME	FACULTY
I	(A) Stereo Chemistry (I) [07 Marks] Optical activity in the absence of chiral carbon (Biphenyls, Allenes and Spirans)	Dr. D. N. Dave
	(B) Stereoselectivity and Stereospecificity [07 Marks] Stereoselective and stereospecific reactions. Mechanism "Addition of halogens to alkenes". Stereochemistry of E2 reaction (syn and anti elimination).	Dr. D. N. Dave
II	(A) Inorganic reagents for Organic synthesis [07 Marks] Use of specific reagents and their synthetic applications with mechanism. (i) Aluminium Isopropoxide (ii) Lithium Aluminium Hydride (iii) Adams's catalyst (PtO ₂) (iv) Selenium Dioxide (v) Osmium Tetroxide (vi) Lead Tetraacetate	Dr. S. P. Gami
	(B) Molecular rearrangements and Name Reactions [07 Marks] Rearrangements occurring through Carbocations, carbenes and nitrenes Principle, Mechanism and Synthetic applications of the reactions: (i) Wolf rearrangement (ii) Fries migration (iii) Hoffmann reaction (iv) Oppenauer oxidation reaction (v) Diels-Alder reaction (vi) Birch Reduction	Dr. S. P. Gami
III	(A) Nucleophilic Substitution at a Saturated Carbon Atom [08 Marks] Mechanism and scope of reaction-available mechanism, Kinetic Characteristics, Scope of reaction, Stereochemistry of SN ₁ and SN ₂ reactions, Relative reactivity in substitution, Solvent effect, variation at carbon site, Relative leaving group activity, S _N i (substitution nucleophilic internal) Mechanism and Neighboring group participation. Elimination Reactions, E ₁ , E ₂ and E ₁ cB mechanism, Orientation E ₁ and E ₂ reactions, Elimination Vs Substitution.	Dr. P. T. Trivedi
	(B) Nucleophilic Aromatic Substitution [06 Marks] Nucleophilic aromatic substitution, Bimolecular displacement and its mechanism, Reactivity, Orientation, Electron withdrawal by resonance, Evidence for the two steps-mechanism, Elimination-addition mechanism-Benzyne.	Dr. P. T. Trivedi
IV	(A) Carbohydrates [06 Marks] Disaccharides, structure of (+) maltose, (+) cellobiose, (+) lactose and (+) sucrose.	Prof. R. M. Jadav
	(B) Purine and Pyrimidines [08 Marks] (i) Purines – Synthesis of Purines, Adenine and Guanine. (ii) Pyrimidines – Synthesis of Pyrimidine, Uracil, Thymine and Cytosine.	Dr. H. C. Sonara

CHE-302 (Inorganic Chemistry)

UNIT	TOPIC NAME	FACULTY
I	<p>Molecular symmetry [14 Marks] Introduction, symmetry operations and symmetry elements: C_n, σ, S_n, i and E. Point groups for the molecules (excluding S_{2n} and I_h). Multiplication tables of C_{2v}, C_{2h} and C_{3v} point groups.</p>	Dr. D. N. Dave
II	<p>(A) Chemical bonding (I) [07 Marks] VB and MO treatment of H_2 and H_2^+, comparison of VB and MO MO treatment of $[FeF_6]^{-4}$, $[Fe(CN)_6]^{1-4}$, $[V(CN)_6]^{-3}$, $[IrF_6]^{-4}$, $[NiF_4]^{-2}$, $[PtCl_4]^{-2}$ and $[Ni(CN)_4]^{-2}$.</p>	Prof. R. M. Jadav
	<p>(B) Boron hydrides [07 Marks] Preparation, properties and structure of diborane. Types of bonds found in higher boranes. Structure of B_4H_{10}, B_5H_9, B_5H_{11}, B_6H_{10} and $B_{10}H_{14}$.</p>	Prof. R. M. Jadav
III	<p>(A) Co-ordination chemistry [07 Marks] Reaction, kinetics and mechanism. Trans effect and trans influence, Applications of trans effect in synthesis and analysis. Theories of trans effect: Polarisation theory, π-bonding theory, MO theory. Lability, inertness, stability and instability.</p>	Prof. J. S. Rana
	<p>(B) Kinetics and reaction rates of substitution [07 Marks] Ligand field effect and reaction rates, mechanism of substitution reaction. Nucleophilic substitution reaction (SN^1 and SN^2) in octahedral complexes. Substitution in square planar Pt(II) complexes. Substitution in octahedral Co (III) complexes. Acid hydrolysis, base hydrolysis. Cis effect. Electron transfer reaction. Mechanism of redox reaction (inner-sphere and outer-sphere).</p>	Prof. J. S. Rana
IV	<p>(A) Inorganic polymers [07 Marks] Classification of inorganic polymers. Polymers containing boron and silicon: methods of preparation, physical and chemical properties, structures and their uses.</p>	Prof. J. S. Rana
	<p>(B) Mossbauer Spectroscopy [07 Marks] Principle and Instrumentation. Experimental technique Application for iron complexes</p>	Prof. J. S. Rana

CHE-303 (Physical Chemistry)		
UNIT	TOPIC NAME	FACULTY
I	Thermodynamics [14 Marks] Zeroth law of Thermodynamics, Clausius - Clapeyron equation, Trouton's Rule, Craft's equation, van't Hoff's isotherm and isochore equations.	Dr. S. B. Teraiya
II	Electrochemistry [14 Marks] Electrochemical cell and Electrolytic cell, Reversible and irreversible electrodes and cell, Poggendorff's compensation method and Weston cell, Reference electrodes (i) Saturated Calomel Electrode (ii) Standard Hydrogen Electrode (iii) Quinhydrone Electrode, Nernst's single electrode potential equation, Applications of emf measurements to calculate ΔG , ΔG° , ΔH , ΔS , K_{eq} , K_{sp} , K_w and K_h .	Dr. P. R. Mevada
III	(A) Chemical Kinetics [07 Marks] Prediction of reaction rate, Primary and secondary salt effect, Heterogeneous reactions, Retarded reaction.	Prof. R. M. Jadav
	(B) Polymer Chemistry [07 Marks] Polymerization and types of Polymerization, Co-polymers, Bio-polymers, Polymer additives, Thermodynamics of polymer solution, Molecular weight determination of polymers: Number average molecular weight, Weight average molecular weight, Viscosity and Osmotic pressure method.	Dr. P. R. Mevada
IV	(A) Nuclear Chemistry [07 Marks] Detection of isotopes, Velocity focusing mass spectrograph, Bainbridge and Neiers mass spectroscopy, Double focusing mass spectroscopy, Applications of isotopes and trace technique examples	Dr. P. R. Mevada
	(B) Molecular spectra [07 Marks] Pure rotational spectra, Equation for frequency of pure rotational spectral line, Vibrational Rotational spectra, Equation for frequency of vibrational-rotational spectral line, Ortho and Para hydrogen.	Dr. H. C. Sonara

CHE-304 (Analytical Spectroscopic Techniques)

UNIT	TOPIC NAME	FACULTY
I	(A) Ultraviolet Spectroscopy [08 Marks] Origin of UV Spectra, Principle, Electronic transition ($\sigma\text{-}\sigma^*$, $n\text{-}\sigma^*$, $\pi\text{-}\pi^*$ and $n\text{-}\pi^*$), relative positions of λ_{max} considering conjugative effect, steric effect, solvent effect, red shift (bathochromic shift), blue shift (hypsochromic shift), hyperchromic effect, hypochromic effect (typical examples). Aromatic and Polynuclear aromatic hydrocarbons.	Dr. M. D. Patel
	(B) Ultraviolet Spectroscopy (Problems) [06 Marks] Problems of Dienes and enones using Woodward-Fieser rules. Problems of aromatic ketones, aldehydes and esters using empirical rules.	Dr. M. D. Patel
II	(A) Infrared Spectroscopy [08 Marks] Introduction, principle of IR spectroscopy, instrumentation, sampling technique, selection rules, types of bonds, absorption of common functional groups. Factors affecting frequencies, applications. Application of Hooke's law, characteristic stretching frequencies of O-H, N-H, C-H, C-D, C=C, C=N, C=O functions; factors affecting stretching frequencies (H-bonding, mass effect, electronic factors, bond multiplicity, ring size).	Dr. S. P. Gami
	(B) Raman Spectra [06 Marks] Basic principal, Instrumentation, Application of Raman spectra, Comparison of IR and Raman spectra.	Dr. S. P. Gami
III	(A) Nuclear Magnetic Resonance [07 Marks] Principal, Magnetic and non magnetic nuclei, absorption of radio frequency. Equivalent and non equivalent protons, chemical shifts, anisotropic effect, relative strength of signals, spin-spin coupling, long range coupling, coupling constant, Deuterium labelling, applications to simple structural problems.	Dr. H. C. Sonara
	(B) Problems based on Spectral data [07 Marks] Structural problems based on UV, IR and NMR	Dr. H. C. Sonara
IV	(A) Visible Spectroscopy [06 Marks] Introduction, Beer Lambert's law, instrumentation (light source, optical system, wavelength selector, light sensitive device), Accuracy and error of Spectrophotometry.	Dr. M. D. Patel
	(B) Atomic Spectroscopy [08 Marks] Introduction, Principle, Flame Emission Spectroscopy (FES) and Atomic adsorption Spectroscopy (AAS), Principal, comparison and applications, Burners (Total consumption burner and Premix burners), Inductively coupled plasma Emission Spectroscopy (ICPES)	Dr. M. D. Patel

CHE-305 (Subject Elective) Soil Composition and Analysis		
UNIT	TOPIC NAME	FACULTY
I	Introduction to Soil Chemistry [14 Marks] Importance of soil, soil formation, composition of soil, the soil profile, types of soil, micro and macro plant nutrients.	
II	Analysis of Primary Nutrients [14 Marks] Soil fertility and productivity, techniques for the analysis of soil, soil reaction, determination of total nitrogen in soil, determination of phosphorus in soil, determination of potassium in soil by flame photometry.	
III	Analysis of Secondary Nutrients [14 Marks] Determination of total sulphur in soil, determination of calcium in soil determination of magnesium in soil, determination of lime and liming material in soil. Mechanical analysis of soil.	Dr. S. P. Gami
IV	Analysis of Micro Nutrients [14 Marks] Determination of total manganese in soil, determination of Fe (II) and Fe (III) in soil, determination of silica in soil, determination of soluble salts in soil, determination of sodium in soil by flame photometry.	Dr. S. B. Teraiya

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Bhavan's Sheth R. A. College of Science, Ahmedabad-1
Allotment of Topics
B.Sc. Sem- III (Chemistry)

CHE-201 (Organic Chemistry)		
UNIT	TOPIC NAME	FACULTY
I	[A] Carbohydrates [Marks -8] Introduction, classification of carbohydrates, osazone formation, epimerization, step up and step down reactions of monosaccharides, simple structures of glucose and fructose, Fischer's proof of configuration of D-glucose.	Dr. M. D. Patel
	[B] Amino acid : [Marks -6] Introduction of amino acid, Classification and properties of amino acids, Zwitter ion , Isoelectric point, Strecker's and Gabreil pthalimide synthesis of amino acids.	Dr. M. D. Patel
II	[A] Electrophilic aromatic Substitution: [Marks -8] Introduction, effect of substituent groups, determination of orientation and relative reactivity, classification of substituent groups, electrophilic substitution (ES) reactions. (Nitration, Sulfonation, Halogenation, Friedel Craft alkylation and acylation), Orientation in mono and disubstituted benzene.	Dr. M. D. Patel
	[B] Polynuclear hydrocarbon [Marks -6] Nomenclature, structure and synthesis of Naphthalene and its derivatives. Reactions (oxidation, reduction and electrophilic substitution reaction (ESR)) of naphthalene.	Dr. M. D. Patel
III	[A] Heterocyclic Compounds [Marks -8] Introduction, structure of Pyrrole, Furan and Thiophene, Paal Knorr synthesis and electrophilic substitution of Pyrrole, Furan and Thiophene, reactivity and orientation of electrophilic substitution reactions (ESR) in five membered heterocycles (Pyrrole, Furan and Thiophene) Structure of Pyridine, Electrophilic and Nucleophilic substitution reactions of pyridine. Basicity of pyridine.	Dr. P. T. Trivedi
	[B] β-dicarbonyl compounds [Marks -6] Introduction, synthesis of Ethyl acetoacetate (EAA) and Diethylmalonate Acidic and ketonic hysrolysis of β -dicarbonyl compounds, Synthetic applications of β -dicarbonyl compounds. (i) Crotonic acid from EAA (ii) Valeric Acid from diethyl malonate	Dr. P. T. Trivedi
IV	Chemical Reactivity and Molecular Structure: (Acid- Base Properties) [Marks-14] Acid-Bases, scale of acidity-basicity, Resonance effect, drawing of structures and the condition for resonance, Effect of change of hybridization on acidity and basicity, Inductive and electronic effects, steric effect and hydrogen bonding, Lewis acid and bases, Keto – enol tautomerism . Difference between resonance and tautomerism.	Dr. D. N. Dave

CHE-202 (Physical Chemistry)

UNIT	TOPIC NAME	FACULTY
I	(A) Thermodynamics [8 marks] Physical significance of entropy; Entropy change during phase change - solid to liquid and liquid to vapor; Entropy of mixing of ideal gases; Entropy change in reversible and irreversible process; Work and free energy functions; Helmholtz function and variation of free energy change with temperature and pressure; Gibbs Helmholtz equation, derivation.	Dr. S. B. Teraiya
	(B) Chemical Kinetics [6 marks] Theories of reaction rates: Collision theory of bimolecular gaseous reactions and Activated Complex theory of bimolecular reactions; Effects of temperature on reaction rates; Derivation of Arrhenius equation.	Dr. S. B. Teraiya
II	(A) Electrochemistry [8 marks] Transport number; Determination of transport numbers by moving boundary method; Conductometric titrations: Principle and advantages; Titration of Strong acid against strong base (HCl vs NaOH); Titration of Weak acid against strong base (CH ₃ COOH vs NaOH); Titration of Strong acid against weak base (HCl vs NH ₄ OH); Titration of very weak acid against strong base (H ₃ BO ₃ vs NaOH); Titration of mixture of acids against strong base (HCl + CH ₃ COOH vs NaOH); Activity and activity coefficient; Ionic strength	
	(B) Phase Rule [6 marks] Theoretical derivation of phase rule; One component system : water system and sulphur system; Condensed phase rule; Silver – lead (Ag-Pb) system;	Dr. S. P. Gami
III	(A) Adsorption [8 marks] Definition of terms, Types of adsorption (physical, chemical and their difference), Types of adsorption isotherms (5 types), Derivation of Freundlich adsorption isotherm, Derivation of Langmuir adsorption isotherm, Applications of adsorption	Dr. S. P. Gami
	(B) Catalysis [6 marks] Characteristic of catalysis, Homogenous and heterogeneous catalysis, Enzyme catalysed reaction and derivation mechanism, Marten reaction	
IV	(A) Polymer Chemistry [8 marks] Definition: Monomer, Polymer, Polymerization, Classification of Polymers; Chain polymerization: Free radical and Ionic polymerization [cationic and anionic], Coordination polymerization, Step polymerization: Polycondensation and Polyaddition and Ring Opening Polymerization.	Dr. P. R. Mevada
	(B) Colloids [6 marks] Colloidal Systems; Preparation of Colloidal Solutions; General Properties of Colloidal Systems; Properties of hydrophobic Colloidal Systems	Dr. P. R. Mevada

Bhavan's Sheth R. A. College of Science, Ahmedabad-1
Allotment of Topics
B.Sc. Sem- I (General Chemistry)

CHE-101 (General Chemistry)		
UNIT	TOPIC NAME	FACULTY
I	Inorganic Chemistry (14 Marks)	
	(a) Lanthanides Electron configuration, Oxidation states, Magnetic properties, Colour and absorption spectra of lanthanide ions, Lanthanide contraction, Separation and purification of Lanthanides: Ion-exchange and solvent extraction methods.	Prof. J. S. Rana
	(b) Actinides Electron configuration, Oxidation states, Magnetic properties, Color and absorption spectra of actinide ions, actinide contraction, Nuclear synthesis of trans uranic elements, Chain reaction, importance of Uranium, Comparison with lanthanide.	Prof. J. S. Rana
II	Organic Chemistry (14 Marks)	
	(a) Quantitative Analysis & Determination of Molecular Formula Determination of Nitrogen by Kjeldahl's method and Kjeldahl's method modified with boric acid. Molecular weight of organic acid by Ag-salt method and organic base by Chloroplatinate method, Numerical based on empirical and molecular formula.	Dr. H. C. Sonara
	(b) Fundamentals of Organic Reactions Fission of covalent bond, types of reagents, Substitution Nucleophilic Unimolecular reaction mechanism (SN1), Substitution Nucleophilic Bimolecular reaction mechanism (SN2), Electrophilic Aromatic Substitution-Elementary treatment only (Nitration, Sulfonation, Halogenation & Friedel-Crafts Alkylation and Acylation)	Dr. H. C. Sonara
III	Organic Chemistry (14 Marks)	
	(a) Alkanes:- (Saturated Hydrocarbons) Introduction, IUPAC nomenclature, Reduction of R-X, Wurtz's reaction, Hydrolysis of R-Mg-X, Decarboxylation of acid, Kolbe's electrolytic process, Free radical mechanism (Chlorination of Methane).	Dr. D. N. Dave
	(b) Alkenes & Alkynes:- (Unsaturated Hydrocarbons) Introduction, IUPAC nomenclature, Preparations (dehydration, dehalogenation, dehydrohalogenation), Reactions with H ₂ , X ₂ , HX, HOCl, H ₂ SO ₄ , and Hydroboration; Oxidation reactions: (i) with cold alkaline KMnO ₄ (Baeyer's reagent), (ii) Oxidative cleavage with acidified or hot KMnO ₄ , (iii) Ozonolysis (O ₃); Polymerization; Reactions of terminal Acetylenes: (i) Addition of water, (ii) Na / liquid NH ₃ .	Dr. D. N. Dave

IV	Physical Chemistry	(14 Marks)
	(a) Thermodynamics:- Zeroth law, first law, Second law of thermodynamics; proof of 2nd law (Carnot's Cycle); Entropy, of Gas and calculation of entropy for different processes; Kirchhoff's equation.	Dr. P. T. Trivedi
	(b) Chemical Kinetics:- Basic terms: molecularity, order of reactions. Unit for rate constant; Derivation of: first order rate constant, Second order rate constant for (a=b) and (a ≠ b). Third order rate equation (a=b=c). Determination of Half Life Time for 1 st , 2 nd and 3 rd order reactions.	Dr. P. T. Trivedi