Chemistry Subject as a Major Discipline

SEMESTER-V

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
DSC5 As a Major Subject	21BSC5C5CHMMN1L	CHEMISTRY: CHM T-5	40	60	100	4	-	-	4	2
	21BSC5C5CHMMN1P	CHEMISTRY LAB :CHMP-5	25	25	50	-	-	4	2	3
DSC6 As a Major Subject	21BSC5C5CHMMJ2L	CHEMISTRY: CHM T-6	40	60	100	4	-	-	4	2
	21BSC5C5CHMMJ2P	CHEMISTRY LAB : CHM P-6	25	25	50	-	-	4	2	3

SEMESTER-VI

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
DSC7 As a Major Subject	21BSC6C6CHMMN1L	CHEMISTRY: CHM T-7	40	60	100	4	-	-	4	2
	21BSC6C6CHMMN1P	CHEMISTRY LAB :CHM P-7	25	25	50	-	-	4	2	3
DSC8 As a Major Subject	21BSC6C6CHMMJ2L	CHEMISTRY: CHM T-8	40	60	100	4	-	-	4	2
	21BSC6C6CHMMJ2P	CHEMISTRY LAB : CHM P-8	25	25	50	-	-	4	2	3

ಅಧ್ಯಕ್ಷರು BOS 21/08/23
ರಸಾಯನ ಶಾಸ್ತ್ರ ಅಧ್ಯಯನ ವಿಭಾಗ
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ಶಿವಗಂಗೋತ್ರಿ, ದಾವಣಗೆರೆ-577007

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Davangere University
Department of Chemistry
V Semester Chemistry,Syllabus

Chemistry Paper 5 : Advanced Inorganic and Organic Chemistry I **60 Hours**

Unit I **15 Hours**

Chemistry of main group elements: Concept of multi-center and agostic bonding, Zintl-isoelectronic relationship in solids. Structure and bonding in boranes, carboranes, Wades rules, S,N- compounds. Silicates-Classification, structures, isomorphous replacement, pyroxenes, layered and vitreous silicates, zeolites and molecular sieves. HSAB concept: Basis of HSAB concept, acid-base strength, hardness and softness, symbiosis, applications of HSAB concept; Acid- base concept in non-aqueous media, reactions in BrF_3, N_2O_4, anhydrous H_2SO_4, CH_3COOH. Stereoisomerism-Chirality, optical activity- CD, ORD, Cotton effect, absolute configuration of metal complexes, magnetic circular dichroism.

Unit II **15 Hours**

Metal Clusters: M-M bond and metal atom clusters, halide clusters, bonding in [ReCl8]2-. Metal carbonyl clusters- LNCC's and HNCC's. Electron counting in carbonyl clusters, Wades-Mingos and Lauher rules.

Nuclear Chemistry: The atomic nucleus-elementary particles, quarks, classification of nucleides based on Z and N values, nuclear stability, nuclear potential, binding energy. Nuclear Models: Shell model-salient features, forms of the nuclear potential, filling of orbitals, nuclear configuration, Liquid drop model, Fermi gas model, Collective model and Optical model. Radioactivity, radioactive decay kinetics, Parent-daughter decay-growth relationship-secular and transient equilibria, theories of a, ß-, ß+ and γ-decay, internal conversion, Auger effect.

Unit III **15 Hours**

Study of Reaction Mechanisms: Hammond postulate, Curtin-Hammett principle. Effect of structure on the strengths of acids and bases. The Hammett equaBon and linear free energy relationship, substituent and reaction constants. Taft equation.

UV Spectroscopy: Types of electronic transiBons, λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λmax for the following systems: a,ß unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers.

IR Spectroscopy: Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance, and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

Unit IV **15 Hours**

Stereochemistry II: Chirality in allenes, alkylidene cycloalkanes and spiranes (with a stereogenic axis). Cram's and Prelog's rules. Conformational analysis: Conformational analysis of cycloalkanes: cyclobutane, cyclopentane, cyclohexanes, and cycloheptane. Prochirality: Enantiotopic and diastereotopic atoms, groups and faces.

Carbohydrates: Introduction. Kiliani-Fischer synthesis, Determination of configuration of the monosaccharides, conformational analysis of monosaccharides. Synthesis of amino sugars (s-D-Glucosamine. Synthesis of gluconic, glucuronic, glucaric acids from glucose. Structure elucidation of sucrose. Structures of lactose, gentiobiose, and meliobiose. Photosynthesis of carbohydrates.

Heterocyclic compounds: Nomenclature of heterocyclic compounds. Structure, reactivity, synthesis and reactions of pyrazole, imidazole, oxazole, thiazole. Preparation and reactionsof coumarins.

Vitamins: Biological importance and synthesis of Vitamin A, Vitamin B1 (thiamine), Vitamin B6 (pyridoxine), Vitamin C, Vitamin E (tocopherol).

Recommended Books/References:

1. Basic Inorganic Chemistry- F. A. CoZon, G. Wilkinson and P. L. Gaus; John Wiley and sons. Inc, 6th ediBon (1999).
2. Advanced Inorganic Chemistry, 6th ediBon; F. A. CoZon and G. Wilkinson.
3. Inorganic Chemistry IV ediBon; J. E. Huheey, E. A. Keiter and R. L. Keiter, Addison; Wesley (1993).
4. Inorganic Chemistry, II ediBon, D. F. Shriver, P. W. Atkins and C. H. Langford, ELBS; Oxford University Press, 1994.
5. Chemistry of elements; N. N. Greenwood and A. E. Earnshaw, BuZerworth Heinemann (1997).
6. Concise Inorganic Chemistry, 5th ediBon; J. D. Lee (1996).
7. EssenBals of nuclear chemistry, 4th ediBon; H. J. Arniker, NAIL publishers (1995); Chapters 1, 3 and 4.
8. Nuclear and RadioacBve chemistry; Friedlander, Kennedy and Miller; Chapters 8 and 9.
9. Inorganic Chemistry, 3rd EdiBon; Gary. L. Miessler and Donald . A. Tarr (2007).
10. Advanced Organic Chemistry - ReacBons, Mechanism and Structure, Jerry March, John Wiley (2008).
11. Advanced Organic Chemistry, F A Carey and R J Sundberg Plenum, (1990).
12. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman, (2000).
13. Structure and mechanism of Organic Chemistry, C K Ingold, Cornell University Press (1999).
14. Organic Chemistry, R T Morrison and R N Boyd, PrenBce-Hall, (1998).
15. Modern Organic ReacBons, H O House, Benjamin, (1972).
16. Principles of Organic Synthesis, R O C Norman and J M Coxon, Blackie Academic and Professional, (1996).
17. Stereochemistry of Organic Compounds, D Nasipuri, New-Age InternaBonal, (1999).
18. Stereochemistry of Carbon Compounds, E L Eliel, S H Wilen and L N Mander, John Wiley, (1994).
19. Stereochemistry, Potapov, MIR, Moscow, 1984.
20. Organic Chemistry, Volumes I and II, I L Finar, Longman, (1999).

Chemistry 5 Practical: Advanced Organic and Inorganic Chemistry I

A: One-step Preparations

1. Preparation of Benzaldehyde by Cannizarro Reaction
2. Preparation of 4-chlorotoluene from 4-toluidine from Sandemeyer Reaction
3. Synthesis of 2,4-dichlorophenoxyacetic acid
4. Cis- and trans- potassium dioxalatodiaquachromium(III) complex
5. Hexamminecobalt(III)chloride
6. Preparation of pentamminechlorocobalt(III)chloride.

Part B: Qualitative Analysis

1. Systematic Qualitative Analysis of a binary mixture of bifunctional organic compounds (3 sessions)
2. Semi micro qualitative analysis of mixtures containing two anions, two common cations and one less familiar elements: W, Mo, Ce, Th, Zr, V, U (3 sessions)

Recommended Books/References:

1. Vogel's Text book of QualitaBve Chemical Analysis, J. BasseZ, G. H. Jeffery and J. Mendham, ELBS (1986).
2. Vogel's text book of QuanBtaBve Chemical Analysis, 5th EdiBon, J. BasseZ, G. H. Jeffery and J. Mendham, and R. C. Denny, Longman ScienBfic and Technical (1999).
3. Inorganic Semimicro QualitaBve Analysis, V. V. Ramanujam; The NaBonal Pub. Co. (1974).
4. PracBcal Inorganic Chemistry, G. Marr and B. W. RockeZ, Von Nostrand Reinhold Co., London (1972).
5. Laboratory manual of Organic Chemistry- B. B. Dey, M V Sitaraman and T R Govindachari, Allied Publishers, New Delhi, (1996).
6. PracBcal Organic Chemistry - Mann and Saunders, (1980).
7. Textbook of PracBcal Organic Chemistry- A. I. Vogel, (1996).
8. Textbook of QuanBtaBve Organic Analysis- A. I. Vogel, (1996).
9. A Handbook of Organic Analysis - Clarke and Hayes, (1964).
10. Comprehensive pracBcal organic chemistry: PreparaBon and quanBtaBve Analysis,
11. V. K. Ahluwalia, R. Aggarwal, UniversiBes Press (India), 2000.
12. Comprehensive pracBcal organic chemistry: QualitaBve analysis, V. K. Ahluwalia, S. Dhingra, UniversiBes Press (India), 2000.
13. An advanced course in pracBcal chemistry, A. Ghoshal, B. Mahapatra and A. Kr. Nad, New central book agency, CalcuZa, 2000.
14. 9. Advanced pracBcal organic chemistry, J. Mohan, Vol. I and II, Himalaya Publishing House, 1992.
15. 10. PracBcal organic chemistry (QuanBtaBve analysis), B. B. Dey, M. V. Sitaraman and T. R. Govindachari, Allied Publishers, New Delhi, 1992.

Davangere University
Department of Chemistry
V Semester Chemistry,Syllabus

Chemistry Paper 6: Advanced Physical Chemistry and Spectroscopy I **60 Hours**

Unit I **15 Hours**

Application of Schrodinger equation to simple systems: Hermitian Condition and properties, Solution of Schrodinger wave equation for (i) A free particle, (ii) a Particle in a three-dimensional box, (iii) Simple Harmonic oscillator, (iv) Rigid Rotor. Quantum mechanical Tunnelling – concept and evidence. Solutions of the Schrodinger equation for hydrogen atom – R, P and F equations, total wavefunctions of hydrogen atom.

Angular Momentum: Operators of angular momentum and their properties, ladder operators

Electron spin: Stern-Gerlach experiment, spin orbitals and Pauli exclusion principle, Slater determinants, Coupling of angular momenta, RS and JJ coupling, term symbols. Spin multiplicites (Na-D doublet)

Approximate methods: Need for approximate methods, Variation theory – statement and proof and application to He atom, Perturbation method (no derivation), application to He atom.

Unit II **15 Hours**

Advanced Chemical Kinetics: *Review: Theories of reaction rate*, collision theory. Activated complex theory – derivation of expression for rate constant based on partition function. Thermodynamic formulation of reaction rates. Influence of ionic strength on reaction rates.

Steady State Kinetics: Chain reactions – steps, chain length and chain inhibition. Derivation of rate constant for thermal and photochemical reactions of hydrogen-bromine. Pyrolysis of acetaldehyde.

Enzyme Catalysis: Effect of substrate concentration: Henri-Michaelis-Menten mechanism, the significance of K_M and k_{cat}. Effect of enzyme concentration, pH, temperature, activators and inhibitors

Unimolecular Reactions: Perrin, Lindelmann and Hinshelwood theories.

Unit III **15 Hours**

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, the amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies. Fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, and group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

Unit IV **15 Hours**

Raman spectroscopy: Theory relation with IR Spectroscopy Experimental techniques Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

Electron Spin Resonance (ESR) spectroscopy: principle, hyperfine structure, ESR of simple radicals

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift, spin-spin coupling and high-resolution spectra, interpretation of PMR spectra of organic molecules. Interpretation of NMR spectra of simple compounds. Combined Applications of IR, UV and NMR for identification of simple organic molecules.

Recommended Books/References:

1. Physical Chemistry, P. W. Atkins, Julio de Paula, ELBS, 7th ediBon, (2002).
2. Physical Chemistry: A Molecular Approach, McQuarie and Simon, Viva, New Delhi, (2001).
3. IntroducBon to Quantum Chemistry, A. K. Chandra, Tata McGraw Hill, (1988).
4. Quantum Chemistry, Ira. N. Levine, PrenBce Hall, New Jersey, (1991).
5. Quantum Chemistry, R. K. Prasad, New Age InternaBonal, 2nd ediBon, (2000).
6. Quantum Chemistry through problems and soluBons, R. K. Prasad, New Age InternaBonal (1997).
7. Chemical KineBcs- K. J. Laidler, McGraw Hill. Inc. New York (1988).
8. Principles of Chemical KineBcs - House J. E. Wm C Brown Publisher, Boston, (1997).
9. KineBcs and Mechanism - A. A. Frost and R. G. Pearson, John-Wiley, New York, (1961).
10. Chemical KineBc Methods - C. Kalidas, New Age InternaBonal Publisher, New Delhi (1995)
11. S.H. Maran and C. F. Pruton, 4th Edn., Oxford, & IBH publishing Co. Pvt. Ltd. New Delhi (1965).
12. Physical Chemistry- P. Atkins and J. D. Paula, 9th Edn., Oxford University Press (2010).
13. Biochemistry, - Geoffrey Zubay, 2nd Edn.,Macmillan Publishing Co. New York (1981).
14. KineBcs and Mechanism of Chemical TransformaBons- J. Rajaraman and J. Kuriakose, Mc Millan.
15. Laideler K. J. and Meiser J. M. Physical Chemistry Third EdiBon (InternaBonal)1999
16. 2. Levine I. N., Physical Chemistry, Fourth EdiBon), McGraw-Hill (InternaBonal), 1995.
17. McQuarrie D. A. and Simon J. D. Physical Chemistry- A Molecular Approach, University Science Books, 1998.
18. P.W. Atkins: Physical Chemistry.
19. G.W. Castellan: Physical Chemistry.
20. Banwell, C. N. & McCash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed.Tata McGraw-Hill: New Delhi (2006).
21. Brian Smith: Infrared Spectral InterpretaBons: A SystemaBc Approach.
22. Kemp, W. Organic Spectroscopy, Palgrave
23. Principles of Instrumental Analysis - 6th EdiBon by Douglas A. Skoog, F. James Holler, and Stanley Crouch (ISBN 0-495-01201-7).
24. Instrumental Methods of Analysis, 7th ed, Willard, MerriZ, Dean, SeZle.

Chemistry 6 Practical: Advanced Physical Chemistry I

Part A

1. Verification of Beer's Law for Cu^{2+} ions
2. Verification of Beer's Law for Fe^{2+} ions
3. Estimation of Fe2+ ions concentration in the given solution by titration of FAS versus $KMnO_4$ through colorimetric method.
4. Estimation of Fe2+ ions concentration using EDTA through colorimetric method
5. Determination of the partial molar volume of solute -H2O system by apparent molar volume method.
6. Determination of the viscosity of a mixture by apparent molar volume method.

Part B

1. Precipitation titration: conductometric titration of lithium sulphate versus BaCl2
2. Conductometric BtraBon of weak acid versus weak base.
3. Determination of single electrode potential of Cu2+/Cu and estimate the given unknown concentration.
4. Potentiometric titration of $AgNO_3$ versus KCl
5. Titration of weak acid against a strong base using quinhydrone electrode and calculation of pK_a and K_a values of the weak acid.
6. Determination of pH of a buffer by using a quinhydrone electrode and comparison of the pH values obtained with glass electrode.

Recommended Books/References:

1. Findlays pracBcal physical chemistry revised by P. B. LeviZ, Longman's London (1966).
2. Experiments in Physical Chemistry by Shoemaker and Garland, McGraw Hill InternaBonal Edn. (1966)
3. Advanced PracBcal Physical Chemistry by J. B. Yadav, Goel PublicaBons Meerut (1988)
4. Senior PracBcal Physical Chemistry by B. C. Kosla, Simla Printers New Delhi (1987)
5. Experimental Physical Chemistry by Daniel et al., McGraw Hill, New York (1962).
6. PracBcal Physical Chemistry by A.M James and P. E. Pritchard, Longman's Group Ltd (1968)
7. Experimental Physical Chemistry by Wilson, Newcombe & others, Pergamon Press, New York (1962)
8. Experimental Physical Chemistry by R. C. Behra and B Behra, Tata McGraw, New Delhi (1983)
9. Experimental Physical Chemistry by V. D. Atavale and Parul Mathur, New Age InternaBonal, New York (2001)
10. Physical Chemistry Laboratory Principles and Experiments by H. W. Salberg J. I. Morrow, S. R. Cohen and M. E.
Green Macmillan publishing Co .new York.
12. PracBcal's in physical chemistry A. Modern Approach by P.S Sindhu, Mac. Millan Publishers Delhi
13. Physical Chemistry of Surfaces- A. W. Adamson, Interscience Publisher Inc., New York (1967).
14. Surface Chemistry: Theory and ApplicaBons, J. J. Bikerman, Academic Press. New York (1972).

Davangere University
Department of Chemistry
VI Semester Chemistry,Syllabus

Chemistry 7: Advanced Inorganic and Organic Chemistry II **60 Hours**

Unit I **15 Hours**

Coordination Chemistry: Step-wise and overall formation constant and their relationship, trends in step-wise constant, kinetic and thermodynamic stability of metal complexes, factors affecting the stability of metal complexes with reference to the nature of the metal ion and ligand, chelate effect, macrocyclic effect and their thermodynamic origin. Structure and bonding- Structure and bonding in hydride, dihydrogen, dioxygen, isocyanide.

Stereoisomerism: coordination numbers 3 to 8. Crystal field theory, salient features, spectrochemical series, spliJng of d-orbitals in tetragonal, square planar, trigonal bipyramidal and square-pyramidal geometry, applications of CFT- colours of transition metal complexes, magnetic properties of octahedral complex, limitationsof CFT.

Unit II **15 Hours**

Electronic spectra of coordination compounds: Spectroscopic ground states, selection rules, term symbols for dn ions, Racah parameters, Orgel, Correlation and Tanaube-Sugano diagrams, spectra of 3d metal-aqua complexes of trivalent V, Cr, divalent Mn, Co and Ni, calculation of Dq, B and beta parameters, CT spectra. Spectral properties of Lanthanide and Actinide metal complexes.

Magnetic properties of coordinaton compounds: Types of magnetic behaviour, magnetic susceptibility, and its determination- Gouy method. Diamagnetic correction, orbital contribution, spin-orbital coupling, ferro- and antiferromagnetic coupling, spin- crossover. Magnetic properties of Lanthanide and Actinide metal complexes.

Unit III **15 Hours**

Aromatic substitution reactions: Quantitative treatment of reactivity in substrates and electrophiles.Effect of leaving group.Amination, sulfonylation reactions; Diazonium coupling, Vilsmeier-Haack reaction, Gatterman reaction, Gatterman-Koch reaction and Hoesch reaction.

Nucleophilic substitution reactions: SNAr mechanism, Goldberg reaction, Bucherer reaction, Schiemann reaction, von Richter reaction.

Elimination Reactions: E2C and E2H mechanisms. Orientation of the double bond. Reactivity-effects of substrate structure, attacking base, the leaving group and the medium. Mechanism and orientation in pyrolytic elimination reactions.

Unit IV: **15 hours**

Addition reactions: Addition to carbon-carbon multiple bonds: mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles, and free radicals. Regio, stereo- and chemoselectivities. Orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings. Addition of alkenes and/or alkynes to alkenes and/or alkynes. Ene synthesis. Michael reaction.

Rearrangements: Wagner-Meerwein, Fries, Wolff, Beckmann, Hofmann, Curtius, Lossen and Schmidt rearrangements. Benzil-benzilic acid rearrangement, Arndt-Eistert reaction, – Demjanov reaction. Stevens, WiJg and Favorskii rearrangements, Dienone-phenol, Baker-Venkatraman rearrangement. Baeyer-Villiger oxidation.Neber rearrangement. Benzidine rearrangement.

Recommended Books/References:

1. Basic Inorganic Chemistry- F. A. CoZon, G. Wilkinson and P. L. Gaus; John Wiley and sons. Inc, 6th ediBon (1999).
2. Chemistry of elements- N. N. Greenwood and A. E. Earnshaw, BuZerworth Heinemann (1997).
3. Inorganic Chemistry IV ediBon; J. E. Huheey, E. A. Keiter and R. L. Keiter, Addison; Wesley (1993).
4. Inorganic Chemistry, II ediBon, D. F. Shriver, P. W. Atkins and C. H. Langford, ELBS; Oxford University Press,1994.
5. Inorganic Electronic spectroscopy, A. B. P. Lever, Elsevier. (1968).
6. Magnetochemistry, R.L. Carlin, Springer Verlag.
7. Electronic AbsorpBon Spectroscopy and related Techniques, D. N. Sathyanarayana, University Press (2001).
8. Inorganic Chemistry A Unified Approach by W. W. Porterfield, Elsevier 2005 2nd ediBon.
9. Textbook of inorganic chemistry by G. S. Sodhi, Viva books Pvt. Ltd (2011).
10. Advanced Organic Chemistry - ReacBons, Mechanism and Structure, Jerry March, John Wiley (2008).
11. Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg, Plenum (1990).
12. A Guide Book to Mechanism of Organic Chemistry, Peter Sykes, Longman (2000).
13. Structure and Mechanism of Organic Chemistry, C. K. Ingold, Cornell University Press.
14. Organic Chemistry, R. T. Morrison and R. N. Boyd, PrenBce-Hall (1998).
15. Modern Organic ReacBons, H. O. House, Benjamin (1972).
16. Principles of Organic Synthesis, ROC Norman and J. M. Coxon, Blackie Academic and Professional (1996).
17. Stereochemistry of Organic Compounds, D. Nasipuri, New-Age InternaBonal (1999).
18. Stereochemistry of Carbon Compounds, E. L. Eliel, S. H. Wilen and L. N. Mander, John Wiley (1994).
19. Organic Chemistry, Volumes I and II, I L Finar, Longman. (1999).
20. Medicinal Chemistry, A Kar, Wiley (2000).
21. PepBdes Chemistry: A pracBcal text book, M. Bodansky, Springer-Verlag NY, 1988.
22. Solid-phase pepBde synthesis: A pracBcal approach-E. Artherton & R.C. Sheppard, I R L, Oxford Univ. Press, 1989.
23. PepBdes: Chemistry and Biology, N Selwad and H.-D. Jakubke, Wiley-VCH, 2002.

Chemistry 7 Practical: Advanced Inorganic and Organic Chemistry II

Part A

1. Gravimetric determination of Fe in iron ore as Fe2O3.
2. Gravimetric determination of Ni in Cu and Ni solution.
3. Total gravimetric estimation of Fe and Al.
4. Volumetric estimation of Ca and Mg in Dolomite solution.
5. Volumetric estimation of Cu in Cu and Ni (German Silver).
6. Volumetric estimation of Zn in Cu and Zn solution.

Part B

1. Anthranilic acid from phthalic acid.
2. Benzanilide from benzophenone.
3. Benzilic acid from benzoin.
4. Titrimetric estimation of amino acids.
5. Saponification value of oil.
6. Estimation of glucose by Fehling's method.

Recommended Books/References:

1. Vogel's text book of QuanBtaBve Chemical Analysis, 5th EdiBon, J. BasseZ, G. H. Jeffery and J. Mendham, and R. C. Denny, Longman ScienBfic and Technical (1999).
2. PracBcal Inorganic Chemistry, G. Marr and B. W. RockeZ, Von Nostrand Reinhold Co., London (1972). Laboratory manual of Organic Chemistry- B. B. Dey, M V Sitaraman and T R Govindachari, Allied Publishers, New Delhi, (1996).
3. PracBcal Organic Chemistry - Mann and Saunders, (1980).
4. Text Book of PracBcal Organic Chemistry- A. I. Vogel, (1996).
5. Test Book of QuanBtaBve Organic Analysis- A. I. Vogel, (1996).
6. Comprehensive pracBcal organic chemistry : PreparaBon and quanBtaBve Analysis, V. K. Ahluwalia, R. Aggarwal, UniversiBes Press (India), 2000.
7. An advanced course in pracBcal chemistry, A. Ghoshal, B. Mahapatra and A. Kr. Nad, New central book agency, CalcuZa, 2000.
8. Advanced pracBcal organic chemistry, J. Mohan, Vol. I and II, Himalaya Publishing House, 1992.
9. PracBcal organic chemistry (QuanBtaBve analysis), B. B. Dey, M. V. Sitaraman and T. R. Govindachari, Allied Publishers, New Delhi, 1992.

Davangere University
Department of Chemistry
VI Semester Chemistry,Syllabus

Chemistry Paper 8 : Advanced Physical Chemistry and Spectroscopy II **60 Hours**

Unit I **15 Hours**

Thermodynamics: Partial molar properties – chemical potential, partial molar volume and its significance. Derivation of phase rule from the concept of chemical potential. Gibbs-Duhem and Gibbs-Duhem-Margules Equations, Determination of partial molar volume by intercept method. Concept of fugacity, determination of fugacity by compressibility factor method. Activity andactivity coefficient, determination by EMF method.

Statistical thermodynamics: Objectives, concept of distributions, types of ensembles, Maxwell-Boltzmann statistics, Most probable distribution law. Concept of bosons and fermions, Derivation of distribution laws for Fermi-Dirac and Bose-Einstein statistics.

Partition functions: Definition and significance, molar and molecular partition functions, Derivation of expression of partition function for rotational, vibrational, electronic,and translational motion. Sackur Tetrode Equation, Relation between equilibrium constant and partition function.

Unit II **15 Hours**

Electrochemistry: Ionic atmosphere, Debye-Hückel theory for the problem of activity coefficient, Debye-Hückel limiting Law, Debye-Hückel equation for appreciable concentration, Debye-Hückel-Onsager conductance equation and its extension to ion solvent interactions, Debye-Hückel-Bjerrum mode, Ion association, triple ions, triple ions and conductance minima. Thermodynamics of electrified interface, derivation of electro capillary Lipmann's equation, surface excess, thermodynamic aspects of surface excess. The method of determination and measurement of interfacial tension as a function of applied potential difference across the interface.

Structure of electrified interface: Helmholtz model, Guoy- Chapman model, Stern model. Semiconductor-electrolyte interface.

Electrode Kinetics: Overpotential: Concentration overpotential and activation overpotential, Derivation of Butler-Volmer equation.

Polarography: Ilkovic equation, half wave potential and its significance, qualitative and quantitative estimation of metal ions.

Unit III **15 Hours**

Group theory: Definition of groups, subgroups, cyclic groups, conjugate relationships, classes, simple theorems in group theory. Symmetry elements and symmetry operations, point groups, Schoenflies notations, representations of groups by matrices, reducible and irreducible representations, characters of representations, Great Orthogonality Theorem (without proof) and its applications, character tables and their uses (representations for the Cn, Cnv, Dnh groups to be worked out explicitly) Mulliken symbols for irreducible representations Direct products.

Infrared Spectroscopy II: Infrared spectra of coordination compounds, changes in infrared spectra of donor molecules upon coordination (N,N-dimethylacetamide, pyridine N-oxide, ammine, cyano, & complexes), mono and multinuclear carbonyl complexes, nitrosyls, phosphine and arsine complexes. Change in spectra accompanying change in symmetry upon coordination Bon (NO_3, SO_4 , hydrogen bonding.

Unit IV **15 Hours**

Nuclear magnetic resonance spectroscopy II: effect of chemical exchange on spectra. Analysis of complex NMR spectra, and complex metal ligands. Spin-systems: First order and second order patterns. Long range coupling: Spin decoupling,. NMR shift reagents. C-NMR: Broad band and off resonance, decoupling methods,use of NMR studies of nuclei other than proton, other nuclei viz., C-NMR in structural determination of organic and inorganic molecules. contact shift, double resonance technique.

Mossbauer spectroscopy: Introduction, principles, conditions for Mossbauer spectroscopy, parameters from Mossbauer spectra, isomer shifts, electric quadrupole interaction, magnetic exchange on spectra.

Nuclear Quadrupole Resonance (NQR) Spectroscopy: Quadrupole nuclei, quadrupole movement, electric field gradient, the NQR experiment, structural information from NQR spectra.

Recommended Books/References:

1. Molecular thermodynamics, Donald A. Mc Quarrie, John D. Simon University Science Books California, (1999).
2. Thermodynamics for Chemists, by S. Glasstone, East-West Press, New Delhi, (1960).
3. Thermodynamics, by Rajaraman and Kuriacose, East-West Press, (1986).
4. StaBsBcal Thermodynamics, M. C. Gupta (Wiley Eastern Ltd.) 1993.
5. Elementary StaBsBcal Thermodynamics, N. D. Smith, Plenum Press, NY, (1982).
6. Elements of Classical and StaBsBcal Thermodynamics, L. K. Nash, Addison-Wiley (1979).
7. Thermodynamics, StaBsBcal Thermodynamics and KineBcs by Thomas Engel & Philip Reid, Pearson EducaBon inc. (2007)
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21. Spectra of Inorganic and CoordinaBon Compounds - K. Nakamoto.
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25. 12.Spectroscopic IdenBficaBon of organic compounds - R. M. Silverstein and F. X. Webster,
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27. 13. InterpretaBon of Mass Spectroscopy-McLafferty.

Chemistry 8: Advanced Physical Chemistry Practical II

Part A

1. Study the hydrolysis of methyl acetate in presence of two different concentrations of HCl and report the relative strength.
2. Study the hydrolysis of methyl acetate in the presence of HCl at different temperatures and report the energy of activation.
3. Determination of dissociation constant of a given indicator by colorimetric method.
4. Determination of degree of hydrolysis of aniline hydrochloride at room temperature and calculation of dissociation constant of the base by pH metry.
5. Analysis of a binary mixture of two miscible liquids and to determine the composition of the given unknown mixture.
6. Determination of pH of acetic acid with sodium acetate buffer by pH metry method..

Part B

1. Conductometric titration of acid mixture versus NaOH.
2. Conductometric titration of weak acid with salt versus NaOH.
3. Potentiometric titration of $K_2Cr_2O_7$ versus FAS
4. Potentiometric titration of acid mixture versus NaOH
5. Determination of dissociation constant of H_3PO_4 using potentiometric method.
6. Determination of pK_a value of phosphoric acid by pH meter.

Recommended Books/References:

1. Findlays pracBcal physical chemisty revised by P. B. LeviZ, Longman's London (1966).

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10. Physical Chemistry Laboratory Principles and Experiments by H. W. Salberg J. I. Morrow,S. R. Cohen and M. E.

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B.Sc Question Paper Pattern

Time: 3 Hrs **PART-A** **Max Marks. 60**

Answer any Five questions. **5X2=10**

1. **a**
   b
   c
   d
   e
   f
   g
   h

Note: Two questions from each unit.

PART-B

Answer any Five of the following questions. **5X4=20**

2
3
4
5
6
7
8
9

Note: Two questions from each unit.

PART-C

Answer any Three of the following questions. **3X10=30M**

10 **(5+5) M**
11 **(5+5) M**
12 **(5+5) M**
13 **(5+5) M**
14 **(5+5) M**

Note: Minimum One question from each unit.

Registrar
Davangere University
Shivagangotri, Davangere

ಅಧ್ಯಕ್ಷರು BoS 21/08/23
ರಸಾಯನ ಶಾಸ್ತ್ರ ಅಧ್ಯಯನ ವಿಭಾಗ
ದಾವಣಗೆರೆ ವಿಶ್ವ ವಿದ್ಯಾನಿಲಯ
ಶಿವಗಂಗೋತ್ರಿ, ದಾವಣಗೆರೆ-577007

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