

Criteria for synthetic polymer formation, Classification of polymerisation process. Bifunctional systems, poly-functional systems. Relationship between functionality, extent of reaction and degree of polymerisation.

**Kinetics of Polymerisation:**

**3Hrs**

Mechanism and Kinetics of step growth, ionic chain (both cationic and anionic) and Coordination polymerisation.

## Organic Chemistry

15hrs

### Module 4: Green Chemistry

8Hrs

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following:

- Green solvents-supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solventless processes.
- Selection of starting materials; avoidance of unnecessary derivatization - careful use of blocking / protecting groups.
- Energy requirements for reactions - alternative sources of energy: use of microwaves and ultrasonic energy.

### Module 5: Green Synthesis

7Hrs

1. Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis).
2. Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols: microwave assisted reactions in organic solvents: Diels-Alder reaction and Decarboxylation reaction.
3. Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine).
4. Surfactants for carbon dioxide - replacing smog producing and ozone depleting solvents with CO<sub>2</sub> for precision cleaning and dry cleaning of garments.

## Physical Chemistry

15hrs

Note (Problems are to solved in SI Units)

### Module-6 Polymers:

4Hrs

Definition, Classification, Addition and Condensation Polymerisation - examples -degree of Polymerization, number average, weight average, average molecular weights - Problems to be solved. Determination of molar mass of polymers by Ostwald's Viscosity method. Problems based on intrinsic viscosity - molecular mass relationship.

### Functionality and its importance:

8Hrs

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**DEPARTMENT OF CHEMISTRY**

**SYLLABUS FOR CHEMISTRY ELECTIVE**

**FIFTH SEMESTER**

Total number of lecture hours: 4

5 hrs 3 hrs/wk

**PAPER-VI -CHEMISTRY ELECTIVE**

**Inorganic Chemistry**

**15hrs**

**Module-1 Agro chemistry: Fertilizers:**

**5 hrs**

Requisites of a good fertilizer, types. Manufacture of: Urea by ammonium carbonate, ammonium sulphate by Sindri process, CAN, ammonium phosphate and superphosphate of lime. Straight, compound, mixed and complete fertilizers. Requirement of NPK fertilizers per hectare for various crops (wheat), paddy, millets, maize and pulses

**Module-2 Chemical aspects of biotechnology:**

**3hrs**

Introduction, permutation, merits, favorable conditions, and its types. Manufacture of acetic acid and vitamins by permutation. Deamination.

**Module-3 Organo metallic compounds**

**7hrs**

Definition, classification based on the nature of metal - carbon bond with examples (ionic, sp and multi centered bonds), structural aspects of Zeiss salt and ferrocene, methyl lithium, dimethyl beryllium and trimethylaluminium. EAN rule for metal carbonyls. Preparation structure and bonding aspects of mononuclear and polynuclear carbonyls of 3D metal series,  $\pi$  acceptor behavior of CO, synergic effects (VB approach) - (MO diagram of CO for synergic effect, synergic effect to IR frequencies).

  
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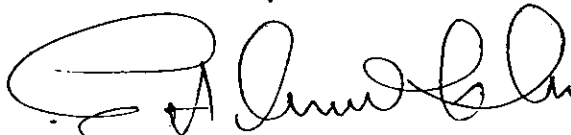
SYLLABUS FOR CHEMISTRY ELECTIVE


FIFTH SEMESTER

BOS members

1 B. S. Usha

2 ~~B. S. Usha~~ 28.5.2018

3  25.05-18

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Chairman - BOS in Chemistry

18. a) Derive the relationship between  $C_p$  and  $C_v$ . (3M)

b) Problem on entropy change. (2M)

19. a) How are racemic mixture resolved by mechanical and chemical method? (4M)

b) State second law of thermodynamics. (1M).

20. a) How are abrasives classified? Write examples. (2M)

b) Describe the electroless plating of copper. (3M)

Answer any **THREE** of the following:

03 X 10=30

21. a) Problem on Dulong's formula. (3M)

b) How is the magnetic susceptibility of a substance determined by Gouy's apparatus. (4M)

c) Describe the preparation of Alumina. (3M)

22. a) Write note on: i) Walden inversion ii) Beckmann rearrangement (4M)

b) Explain: i) Syn- and anti- aldol condensation ii) E and Z notations iii) Racemisation. (6M)

23. Derive: i) Clausius-Clapeyron equation ii) Gibbs-Helmholtz equation. (5+5M)

24. a) How are barbituric acid, amino acids and keto acids synthesized using

Diethylmalonate? (6M)

b) Describe the Carnot's cycle. (4M)

25. a) Explain the differences between 3d, 4d, and 5d series. (4M)

b) Describe the process of electroplating of Gold. Explain the principles of electroplating. (6M)

26. a) Discuss the mechanism of preparation of ethyl acetoacetate by Claisen condensation. What are Threo and erythro enantiomers? (4+2M)

b) Derive Maxwell's thermodynamic relations. (4M).

Signature of the UG board members:

1.

2.

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Chemistry Syllabus (CBCS), Davangere University.

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Question paper pattern:

Davanagere University

B.Sc., Chemistry Theory Question paper

Paper-V: (CBCS-Core)

Time: 3 hrs.

Modern Concepts of Chemistry-I

Max Marks: 80

Note: All parts are compulsory.

PART-A

Write brief note on any TEN of the following:

10 X 02=20

1. Why 3d elements form interstitial and non-stoichiometric compounds?
2. Explain Moh's scale of hardness.
3. Write the composition and uses of zirconia bricks.
4. Mention the characteristics of a good fuel.
5. Define: a) axis of symmetry and b) center of symmetry.
6. What are the properties of Diastereomers?
7. Distinguish between conformation and configuration.
8. Write note on: Keto-enol tautomerism.
9. Mention the criteria for the feasibility of a process.
10. Explain the physical significance of entropy.
11. Problem on effect of temperature on enthalpy of the reaction.
12. Problem on efficiency of a heat engine.

PART-B

Answer any SIX of the following:

06 X 05=30

13. a) How is synthetic petrol manufactured by Fischer-Tropsch method? (4M)  
b) What is RUL test? (1M)
14. a) Describe the manufacture of Alundum. (3M)  
b) Distinguish between HCV and LCV. (2M)
15. a) Explain the optical isomerism in tartaric acid. (3M)  
b) Write the spectroscopic evidences for the existence of keto and enol form of ethyl acetoacetate. (2M)
16. a) Discuss the factors effecting the stability of conformations. (3M)  
b) Explain the acidity of active methylene compounds. (2M)
17. a) Derive expression for the variation of work function with temperature and Volume (4M)  
b) Write the significance of work function. (1M)

31. Instrumental methods of analysis, H. Kaur, Pragati edition.
32. Industrial chemistry by B.K. Sharma.
33. Introduction to green chemistry, Ryan, M.A., American Chemical Society, Washington DC(2002).
34. Green Chemistry: An Introductory Text, RSC Publishing, ii edn, 2010.
35. Introduction to Green Chemistry, Marcel Dekker (2001) by Matlack.
36. Environmental chemistry, by A.K. De. New age international publishers.
37. Perspectives in environmental Studies by Koushik-Koushik, New age international publishers.
38. Text book of Physical Chemistry by Soni, Dharmarha and Dash, Sultan chand and Sons.
39. A text book of Environmental Chemistry and pollution Control, by S.S. Dara, S Chand.
40. Experiments in Applied Chemistry by Sunita Rattan, S.K. Kataria and sons, publisher of engineering and computer books, New Delhi.

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11. Estimation of Ni present in hexamine nickel(II) chloride complex.
12. Estimation of sodium/ potassium by flame photometry.
13. Estimation of ascorbic acid present in citrus fruits.

#### Reference books

1. Advance inorganic chemistry, 5<sup>th</sup> ed. F.A. Cotton and Wilkinson, John Wiley and sons, 1988.
2. Inorganic chemistry, 3<sup>rd</sup> ed. Shriver and Atkins, Oxford university Press, 1999.
3. Concepts and models in inorganic chemistry, 2<sup>nd</sup> ed. Douglas, McDaniel and Alexander.
4. Inorganic chemistry, J. D. Lee, ELBS ed. 1991
5. Theoretical principals of inorganic chemistry, 4<sup>th</sup> ed. G.S. Manu, Tata McGraw Hill, 1996.
6. Modern Inorganic chemistry by R.D. Madan, S. Chand.
7. Inorganic chemistry by R. L. Madan, Mallik and G. R. Tuli
8. Solid state chemistry and its application, R. A. West John Wiley and sons.
9. Engineering chemistry by Jain and Jain. Dhanaptai publishing company limited, 4779/23 Ansari road, Daryaganj, New Dehli-110002.
10. Modern aspects of Inorganic chemistry, H.J. Emelius and A.G. Sharpe. ELBS ed.
11. Organometallic chemistry, a unified approaches R. C. Mehrotra and A. Singh and Wiley Eastern, New Delhi.
12. Elements of statistical thermodynamics by E.K. Nash, Wesley, 1974.
13. Statistical thermodynamics, M. C. Gupta, Wiley Eastern Ltd, 1990.
14. Statistical mechanics by Dole.
15. Text book of polymer science- Billmeyer, Wiley Interscience.
16. Fundamentals of molecular spectroscopy- Banwell, Tata McGraw Hill. 1975.
17. Introduction to molecular spectroscopy - G. M. Barrow, McGraw Hill, New York, 1962.
18. Organic chemistry- Morrison, Boyd-PHI public.
19. Organic chemistry by Ahluwalia.
20. Modern organic chemistry, S.P. Shukla, G. L. Trivedi, S. Chand public.
21. Organic chemistry Bruce, Pearson.
22. College chemistry L. Indira, Himalaya publication house.
23. Organic chemistry, I.J. Finar, ELBS Longman, vol. I and II. 1984.
24. UG- organic chemistry, Jagadamba Singh, LDS Yadav. Vol. I, II and III
25. Medical chemistry Ashutoshkar New Age international publication 3<sup>rd</sup> ed.
26. Analytical chemistry Gray. D. Christian, 5<sup>th</sup> ed. John Wiley and sons.
27. Organic chemistry by Jagmohan, Himalaya publishing house.
28. Principles of bioinorganic chemistry, vikas publication, New Dehli, 2001.
29. Concise coordination chemistry R. Gopalan and V. Ramalingam.
30. Vogel's text book of quantitative analysis - G.H. Jeffery, J. Bassell. Et al. ELBS 5<sup>th</sup> ed. 1996.



## PART-B

1. Preparation of acetanilide from aniline. (Acetylation)
2. Preparation of Aspirin from Salicylic acid. (Acetylation)
3. Bromination of acetanilide.
4. Preparation of methyl orange.
5. Oxidation of toluene or benzyl alcohol or benzaldehyde to salicylic acid.
6. Nitration of benzene or nitrobenzene to dinitrobenzene.
7. Preparation of Grignard reagent (ethyl magnesium iodide).
8. preparation of Nylon-66.

### B.Sc VI Semester Chemistry Laboratory syllabus

#### Practical-VII

3h per week

#### Physical chemistry practical (Electrical and instrumental)

1. Determination of pH of acidic buffer (acetic acid - sodium hydroxide) at different concentrations and calculation of the acid using pH meter
2. Potentiometric titrations: a) Mohr's salt solution > < dichromate solution.
3. Conductometric titration: a) Hydrochloric acid > < sodium hydroxide.  
b) mixture of acetic acid and Hydrochloric acid > < sodium hydroxide
4. Colorimetric titration: a) Copper (II) using ammonia b) Iron (III) using thiocyanate.
5. Determination of rate constant for the inversion of cane sugar using polarimeter.
6. Determination of pKa value of acetic acid by Conductometric method.
7. Determination of pKa value of dibasic acid by Potentiometric method.
8. Determination of percentage composition of binary mixture using Abbe's refractometer.
9. Determination of cell constant (0.1 N solution of KCl to be provided) and determination of equivalent conductance at infinite dilution for a strong electrolyte.

### B.Sc VI Semester Chemistry Laboratory syllabus

#### Practical-VIII

3h per week

#### Analytical methods (analytical and electro-analytical experiments)

1. Determination of total chlorine content in polluted water by iodometric method.
2. Determination of carbon dioxide in water by titrimetric method.
3. Determination of acetic acid in commercial vinegar using sodium hydroxide and alkali content in antacid tablets using hydrochloric acid.
4. Determination of saponification value of ethyl acetate conductometrically.
5. Estimation of iodine present in common salt and available oxygen hydrogen peroxide.
6. Separation and estimation of either Mg(II) or Fe(II) by solvent extraction.
7. Determination of unknown concentration of pot. Permanganate and pot. Dichromate mixture by/ spectrophotometric method.
8. Estimation of protein by colorimetric method.
9. Estimation of cholesterol by colorimetric method.
10. Estimation of cobalt present in chloropentamine(III) chloride complex.

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Polarization, induced, orientation and molar polarization- Clausius-Mosolt equation and its importance (no derivation)

Dipole moment- definition, unit, explanation ( $\text{BF}_3$ ,  $\text{NH}_3$ )- pentaatomic molecules ( $\text{SiCl}_4$ ,  $\text{CCl}_4$ )

Differentiations between cis-trans isomers (1,2-dichloroethene).

B.Sc V Sem Chemistry Laboratory syllabus

Practical-V

3hrs per week

### GRAVIMETRY

#### List of Experiments:

1. Estimation of Barium in barium chloride solution as barium sulphate.
2. Estimation of Sulphate as barium sulphate.
3. Estimation of Iron in iron ore solution as Iron oxide.
4. Estimation of Aluminium in potash alum as aluminium oxide.
5. Estimation of Nickel as nickel dimethyl glyoximate.
6. Estimation of Copper as cuprous thiocyanate.
7. Estimation of Magnesium as oxinate using 8-hydroxy quinoline.
8. Estimation of Zinc as zinc oxide.
9. Estimation of Lead as lead chromate.
10. Electro gravimetric estimation of copper or nickel.

B.Sc V Sem Chemistry Laboratory syllabus

Practical-VI

3h per week

### ORGANIC PREPARATION AND ESTIMATIONS

List of Experiments: (one preparation and Estimation should be given)

#### PART-A

1. Estimation of Amino acid by formal titration method.
2. Estimation of aspirin by base hydrolysis method.
3. Estimation of Aniline.
4. Estimation of Phenol.
5. Estimation of an ester by hydrolysis method.
6. Estimation of glucose by Benedict's method.
7. Estimation of Saponification value of coconut oil.

## PHYSICAL CHEMISTRY

Note: Problems to worked out in SI units

15hrs

### Module-10: Thermodynamics -II

6hrs

Nernst heat theorem- standard entropy- absolute entropy- third law of thermodynamics- statement and its limitation- partial molar quantities- partial molar free energy (chemical potential)- variation of chemical potential with temperature and pressure- Gibb's Duhem equation (derivation)- Duhem Margules equation- definition of fugacity, activity and activity coefficient(Problems).

### Module -11: Quantum mechanics

6 hrs

Definition of system, assembly and ensemble- types of ensemble, occupation number, macro and micro state, statistical weight factor, configuration probability.

Distinguish between classical and quantum statistical mechanics. Postulates of statistical mechanics. Derivation of Maxwell Boltzmann distribution law. Relationship between entropy and thermodynamic probability. Partition function:- definition, derivation for rotational and vibrational partition function.

Expression for thermodynamic functions in terms of partition function (no derivation)- internal energy, enthalpy, entropy, Helmholtz free energy, Gibb's free energy(problems).

### Module -12: Molecular structure:

3hrs

Additive, constitutive and additive- constitutive properties- definition with example.

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Organic Chemistry

15 Hrs

**Module-5 Alkaloids:**

4hrs

Definition, occurrence & extraction of alkaloids. Elucidation of structure of nicotine. synthesis of nicotine by Spath process. Elucidation of structure of ephedrine. Nagai synthesis of ephedrine. Structure and uses of atropine, cocaine, quinine and piperine.

**Module-6: Terpenes:**

4hrs

Definition, classification and isolation of terpenes. Isoprene rule. Structure of geraniol, limonene and zingiberene. Structural elucidation of citral. Synthesis of citral from methyl heptenone. Elucidation of structure of menthol. Kotz and Hessel synthesis of menthol. Synthesis of camphor (Haller process).

**Module-7: Vitamins:**

3hrs

Classification and biological importance of vitamins. synthesis of vitamin C from D(+) Glucose, synthesis of vitamin A. Synthesis of vitamin B<sub>1</sub> (Williams et al.). Structures of vitamin B<sub>2</sub> and vitamin D.

**Module-8 Hormones:**

2hrs

Biological importance of hormones. Synthesis of adrenaline and thyroxine.

**Module-9 Nucleic acids:**

2hrs

**Recapitulation:** Definition of nucleosides and nucleotides. Purine and pyrimidine bases.

Structures of Purine and pyrimidine bases. Synthesis of nucleosides (synthesis of adenosine) and nucleotides (Synthesis of adenosine-5<sup>1</sup>-phosphate).

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## SIXTH SEMESTER

Total number of lecture hours: 45 hrs

3 hrs/wk

### PAPER-VIII - APPLIED CHEMISTRY-II

Inorganic Chemistry

15hrs

**Module-1 Inorganic Polymers:**

3hrs

Silicons - definition, types manufacture, physical properties and applications.

Flourcarbons - definition, properties and users, manufacture of Teflon and its uses.

**Module-2 Instrumental Methods of Analysis:**

5hrs

Thermogravimetry analysis, instrumentation, TG curves, factors affecting TGA. Applications - drying temperature, Curie point, analysis of alloys and absorbed gases.

Atomic absorption spectroscopy (AAS) - principle, instrumentation, hallow cathode lamp, and total consumption burner. Applications determination of Lead in Petrol and Mg in tap water.

**Module-3 Water Pollution**

Definition, sources and toxicity of Pb, Cd, Hg and As, oils and pesticides. Treatment of biological and non-biological wastes, recycling and utilization of waste water.

**Module-4: Acids and Bases**

Lux-Flood theory, Cady-Esley theory and Usanovich concept of acids and bases, Hard and soft acids and bases: definition, classification, characteristic, Peterson's HSAB principle, limitations and applications.

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**Physical Chemistry**

**15Hrs**

(Note-Problems are to solved in SI Units)

**Module - 6 Molecular Spectroscopy:**

**12Hrs**

Introduction, spectrum of electromagnetic radiations, interaction of EMR with molecules, absorption and emission-spectrum, quantisation of different forms of energies (rotation, vibration and electronic) in molecules.

Types of molecular spectra: Diatomic molecule as a rigid rotator, expression for moment of inertia - problem to solved. Rotational energy and wave - number of spectral lines (problems), rotational energy - level diagram. Selection rule and its applications - intensities of spectral lines - determination of moment of inertia and bond length of diatomic molecules.

Infrared Spectroscopy: Vibrational spectra of diatomic molecules, diatomic molecule as a simple harmonic oscillator (one - dimensional), Anharmonicity, Morse potential, dissociation energies, Hook's law and force constant - problems to be solved. Vibrational-energy level diagram. Zero - point energy.

Vibration - Rotation Spectra: Energy expression (no derivation), PQR bands and vibration - rotation spectrum of a diatomic molecule.

**Module - 7 Radiation Chemistry:**

**3 hrs**

Ion pair yield, G-Value, Primary and Secondary process, radiolysis of water. Dosimeter - Fricke dosimeter, Cericsulphate dosimeter biological effects of radiation.

  
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Organic Chemistry 15 Hrs

Module-3 Carbohydrates

8hrs

Classification and nomenclature of monosaccharides (aldotrioses, aldotetroses, aldopentoses & aldohexoses). Mechanism of osazone formation from D(+)-glucose. Conversion of glucose into fructose. Conversion of aldopentose into aldohexose. Determination of configuration of D(+)-glucose and D(-)-fructose. Epimerisation (conversion of glucose into mannose), difference between epimers and anomers. Formation of glycosides. Determination of ring size of D(+)-glucose & D(-)-fructose (six-membered ring structures). Conformational structures of glucose, sucrose and maltose. Anomeric effect (glucose as an example). Concept of mutarotation with mechanism.

**Disaccharides:** Elucidation of structure of maltose and sucrose. Fischer and Haworth structures of cellulose and lactose.

**Polysaccharides:** Partial Structure of starch (amylose and amylopectin) and cellulose.

Module-4 Oils and fats

3hrs

Occurrence, extraction of oils and fats. Common fatty acids, glycerides- simple & mixed. Hydrogenation of unsaturated oils. Hydrogenolysis of oils and fats. Definition, determination and significance of saponification value, iodine value and acid value. Calculation of saponification value of triolein and tripalmitin, Manufacture of soap by hot process. Mechanism of cleansing action of soap. Synthetic detergents, superiority of detergents over soaps. Types of detergents (cationic, anionic and non-ionic). Animal and plant waxes.

Module-5 Amino acids and proteins:

4hrs

**Recapitulation:** Definition and classification of amino acids.

Methods of synthesis of amino acids-Strecker's synthesis, phthalimide synthesis and malonic ester synthesis. Configuration of amino acids, acid-base properties of amino acids, the isoelectric point of amino acids. Separation of amino acids by electrophoresis. N-terminal and C-terminal amino acids.

**Peptides:** Peptide bond. Carbobenzyloxy method of synthesis of peptides. Use of di-tert-butyl dicarbonate (t-BOC) and dicyclohexylcarbodiimide (DCC) in peptide synthesis.

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## SIXTH SEMESTER

Total number of lecture hours: 45 hrs

3 hrs/wk

### PAPER-VII - MODERN CONCEPTS OF CHEMISTRY-II

Inorganic Chemistry

15hrs

#### Module-1 Coordination Chemistry

10hrs

**Recapitulation:** Nomenclature of dinuclear bridged complexes, chelating agents, detection of formation of complexes (colour, conductivity and  $P^H$ ), 18 electron rule.

Bonding in complexes recapitulation. Crystal field theory, features of CFT, crystal field splitting of d-orbitals in octahedral, tetrahedral and square planar complexes, factors affecting crystal field splitting, spectrochemical series, difference between low and high spin complexes on the basis of CFT, colour of the complexes, magnetic properties in octahedral, tetrahedral and square planar complexes. Calculation of number of unpaired electrons in complex, pairing energy and CFSE. Applications of CFT and its limitations.

Stability of complexes. Kinetic Vs thermodynamic stability (properties of CMI, ligands and chelates), experimental determination of stability constant (any one method).

Applications of complexes. In metallurgy, qualitative and quantitative analysis, cis-platin in cancer therapy,  $Na_2$  EDTA in the treatment of heavy metal poisoning (Hg and Pb) and in photography.

#### Module-2 Nanomaterial:

5hrs

Introduction, definition, preparation of nanoparticles from chemical vapour condensation and gas condensation process, carbon nanotubes - electrical, vibrational, thermal and mechanical properties. Applications of carbon nanotubes. General applications of nanomaterial. In medicine, electronics and communications and catalysis.

  
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## Physical Chemistry

15hrs

Note: Numerical problems should be worked out in S.I. units only.

### Module-6 - Photochemistry:

8hrs

Photochemical and thermo chemical reactions: Definition, examples and differences. Laws governing absorption of light, Lambert's law, Beer's law, Lambert-Beer's law, absorption coefficient and their significance. Molar absorption coefficient, molar extinction coefficient and their significance. Construction, working and applications (to be mentioned) of spectrophotometer.

Laws of photo-chemistry: Grotthuss-Draper's law of photochemical equivalence (problems on Einstein law). Quantum yield, high and low quantum yield, reasons for the deviation (problems on quantum efficiency). Primary and Secondary process. Mechanism of photolysis of hydrogen iodide, photosynthesis of hydrogen bromide and hydrogen chloride. Fluorescence, phosphorescence, Chemiluminescence. Bioluminescence, Photosensitization and photo-inhibitors with examples.

### Module-7 Elementary Quantum Mechanics:

7hrs

Classical mechanics-limitation, black body radiation, Planck's radiation law derivation. Postulates of quantum mechanics, derivation of Schrodinger wave equation based on the postulates of quantum mechanics. Eigen values and Eigen functions and their significance, Hamiltonian, Linear and Laplacian operators. Schrodinger wave equation for a particle in a one-dimensional box. Quantization energy and zero point energy.

auxochromes. Hypsochromic and Bathochromic shifts, effect of conjugation on uv absorption. Ex: acetone & methylvinyl ketone, acetone & acetophenone, Cyclohexanal & Benzaldehyde.

Woodward-fieser rules for calculating absorption maximum in dienes (Problems to be solved).

Applications of UV spectroscopy- determination of configuration of geometrical isomers(cis- stilbene&tran-stilbene), determination of strength of hydrogen bonding (acetone in water & acetone in hexane).The UV spectra of acetone and 2-methyl-1,3-butadiene.

**Infrared absorption spectroscopy:**

**4hrs**

Principle of IR spectroscopy.Molecular vibrations-stretching and bending modes of vibration.Intensity and position of IR bands.Finger print region. Functional group region (O-H in alcohols & phenols, C=O in aldehydes & ketones, C-N in amines & amides, C-H in aliphatic & aromatic compounds, N-H in amines and C-O in alcohols..The IR spectra of sec-butylalcohol,phenol,3-pentanone and benzamide.

Applications of IR spectrascopy- Study of keto-enoltautomerism, geometrical isomerism (Cis- & trans- 1,2- dichloroethene),distinction between intramolecular hydrogen bonding & intermolecular hydrogen bonding.

**NMR Spectroscopy:**

**4hrs**

Basic principles of nuclear magnetic resonance, position of signals, Internal standards. chemical shift. Factors influencing chemical shift- Inductive effect (CH<sub>3</sub>F,CH<sub>3</sub>Cl& CH<sub>3</sub>Br to be considered), hydrogen bonding effect, anisotropic effects (Deshielding of aldehyde proton & ethylene protons, Shielding of acetylene protons).Number of signals.Splitting of the signals. Application in structural identification of simple organic molecules-1,1,2-trichloroethane,1,1-dichloroethane, p-xylene, ethanol, acetaldehyde and Benzoicacid. The NMR spectra of propionaldehyde, isopropyl bromide 1, 3-dichloropropane, ethyl bromide and toluene.

**Mass Spectrometry:**

**3hrs**

Basic principles, instrumentation, base peaks, molecular ion, McLafferty rearrangement (butanal to considered). The nitrogen rule.Application mass spectrometry- the mass spectra of 1-bromopropane, toluene, 1-butanol &benzaldehyde.

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## FIFTH SEMESTER

Total number of lecture hours: 45 hrs

3 hrs/wk

### PAPER-VI - APPLIED CHEMISTRY-I

Inorganic chemistry

15 hrs

**Module-1 f-block elements:**

6 hrs

**Lanthanides:** Electronic configuration, ionic size, magnetic properties, complex formation, lanthanides contraction, cause and its consequences, separation of lanthanides by Ion-Exchange method. uses of lanthanides and their compounds.

**Actinides:** Electronic configuration, colour, absorption spectra of actinide ions, comparison between lanthanides and actinides. Extraction/production and uses of Thorium(monazite) and Plutonium(Uranium-238).

**Module-2 Metallic nitrosyl complexes:**

5 hrs

Introduction, Bonding in metallic nitrosyl complexes containing  $\text{NO}^+$  ion,  $\text{NO}^-$  ion, and  $\text{NO}^+$  and  $\text{NO}^-$  together, their formation from NO molecule, calculation of EAN of CMA in metallic nitrosyls. IUPAC names, preparation, properties, uses and structures of nitroso ferrous sulphate and sodium nitroprosside.

**Module-3 Principles of Gravimetric analysis:**

2 hrs

Steps involved in gravimetric analysis, gravimetric factor and its calculation, conditions of precipitation, co-precipitation and post precipitation, industrial applications.

**Module-4 Powder metallurgy:**

2 hrs

Introduction, advantages, disadvantages and limitations, manufacturing process, applications of powder metallurgy.


Organic Chemistry

15 Hrs

**Module-5 Spectroscopy of organic compounds:**

4hrs

Principles of spectroscopy, ultraviolet (uv) absorption spectroscopy -absorption laws- Beer-Lambert Law. Types of electronic transitions, concept of chromophores and

  
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Physical chemistry

15 hrs

**Module -5 Thermodynamics I**

15 hrs

Recapitulation: - System, Surroundings, Process, Extensive and intensive properties. I law of thermodynamics.

Thermodynamic-definition of  $C_P$  and  $C_V$  - Derivation of relationship between  $C_P$  and  $C_V$ .

Kirchoff's equation a) Derivation of effect of temperature on the enthalpy of reaction

b) Derivation of effect of pressure on the enthalpy of reaction. [Problems to be solved].

Statement of Second law of thermodynamics [Clausius & Kelvin]. Spontaneous process, Cyclic process. Heat engine.

Carnot's Cycle: - Derivation of efficiency of heat engine. Statement of Carnot's theorem - Problem to be solved. Entropy - Physical significance of entropy. Second law of thermodynamics in terms of entropy. Entropy - Change during reversible and irreversible process - Entropy Change in phase transition [Problems to be solved] - Derivation of entropy change in reversible and isothermal - expansion of an ideal gas a) T and V are variables b) P and T are variables - problems to be solved.

Helmoltz free energy or Work function - Significance. Derivation of variation of Work function with temp and volume.

Gibb's free energy - Physical significance - Derivation of Gibb's Helmholtz equation and its applications. Derivation of Clausius - Clayperon equation and its applications - problems based on integrated form of Clausius - Clayperon equation.

Maxwell's thermodynamic relations - Derivation.

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Fuels: HCV and LCV. Dulong's formula, problems, characterizes of a good fuel, advantages of gaseous fuels. Manufacture of synthetic petrol by Fischer-Tropsch method.

## Organic Chemistry

15 Hrs

### Module-3 Stereochemistry of organic compounds:

10hrs

**Concept of Isomerism:** Recapitulation optical isomerism, geometrical isomerism. Elements of symmetry-Plane of symmetry, Axis of symmetry, Centre of symmetry.

**Molecular chirality-** enantiomers, diastereomers and their properties. Optical isomerism in Lactic acid and Tartaric acid. Mesocompounds. Homotopic, enantiotopic and diastereotopic hydrogens. Optical activity without asymmetric carbons- Allene derivatives, Biphenyl derivatives. R & S notations for molecules having one and two asymmetric carbons (Cahn- Ingold- prelog system).

Threo and erythro enantiomers. Racemisation, resolution of racemic mixture (mechanical, chemical biochemical & adsorption methods). Walden inversion, asymmetric synthesis. Optical purity (Problems to be solved).

**Geometric isomerism:** Determination of configuration of geometrical isomers- Physical methods, method of cyclisation and method of conversion into compound of known configuration. E and Z notations. Geometrical isomerism of oximes- Syn- and anti- aldoximes and ketoximes. Determination of configuration of oximes, Beckmann rearrangement.

**Conformational isomers:** Factors affecting stability of conformations. Conformational analysis of ethane, 1,2 -dichloroethane, propane, ethylene glycol and cyclohexane. Differences between conformation and configuration.

### Module-4 Active methylene compounds:

5 hrs

Acidity of active methylene compounds. Preparation and synthetic applications of diethylmalonate (mono carboxylic acids, dicarboxylic acids, Keto acids, amino acids, barbituric acid). Preparation of ethyl acetoacetate by Claisen condensation with mechanism. Synthetic applications (mono carboxylic acid,  $\alpha$ ,  $\beta$ -unsaturated acids, ketones and 4-methyl uracil, antipyrine). Keto-enol tautomerism. Spectroscopic evidence for the existence of keto and enol forms of ethylacetoacetate.

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**DAVANAGERE UNIVERSITY**  
**B.Sc., CHEMISTRY SYLLABUS**  
**FIFTH SEMESTER**

Total number of lecture hours: 4

5 hrs 3 hrs/wk

**PAPER-V: MODERN CONCEPTS OF CHEMISTRY- I**

**Inorganic chemistry**

**15hrs**

**Module-1 d-block elements:**

**7hrs**

**Recaptulation.** Oxidation state-minimum and maximum oxidation states, reason, anomalies, relative stabilities of various oxidation states, formation of ionic and covalent compounds on the basis of oxidation states, interpretation of acidic, basic and neutral nature of metal oxides. Formation of interstitial and non-stoichiometric compounds, formation of alloys.

**Magnetic properties:** Para, Dia, Ferri, Ferro and anti -ferro magnetism, origin of paramagnetism, application of magnetic properties in recording tapes, magnetic susceptibility and its experimental determination using Gouy's apparatus, calculation of magnetic moments of metal ion in complexes.

Colour of metal complexes on the basis of CFT, Standard Oxidation and Reduction potentials-explanation, differences between 3d, 4d and 5d series.

**Module-2 Industrial Chemistry: II**

**8 hrs**

**Electroplating:** Purpose of electroplating, nature of deposit, principles of good electroplating, methods of cleaning articles, electroplating of Ni, Cr, and Au.

**Electroless plating -** Definition, preparation of active surface, plating bath, electroless plating of Copper.

**Refractories:** Definition, classification, pyro metric cone equivalent and its values, RUL test, properties of refractories, composition and uses of silica, fireclay and zirconia bricks, Silicon carbide-manufacture, structure and uses.

**Abrasives:** Properties, Moh's scale of hardness, classification-examples, preparation and uses of Alundum.

  
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Courses code, Course titles, Teaching hours Allocation of Marks and Credits.

Course No	Course code	Sem	Titles of the Course	Work load	IA - Marks	Theory/ Practical Marks	Total	Credits
1	Core:1.1 Chemistry Code:16SA-76	I	Fundamentals of Chemistry	4	20	80	100	4
	Che Practical:1.1		Practical -I Trimetry	3	10	40	50	3
2	Core:2.2 Chemistry Code:16SB-76	II	Basic concepts in Chemistry	4	20	80	100	4
	Che Practical:2.2		Practical -II Qualitative analysis of organic compounds	3	10	40	50	3
3	Core:3.3 Chemistry Code:16SC-76	III	Selected topics in Chemistry -I	4	20	80	100	4
	Che Practical:3.3		Practical -III Qualitative analysis of Inorganic compounds	3	10	40	50	3
4	Core:4.4 Chemistry Code:16SD-76	IV	Selected topics in Chemistry -II	4	20	80	100	4
	Che Practical:4.4		Practical -IV Physical Chemistry Non Electrical Expt.	3	10	40	50	3
5	Core:5.5 Chemistry Code:16SE-76	V	Modern concept of Chemistry -I	3	20	80	100	3
	Che Practical:5.5		Practical -V Gravimetry.	3	10	40	50	3
6	Core:5.6A Chemistry Code:16SEA-76	VI-A	Applied Chemistry -I	3	20	80	100	3
	Che Practical:5.6A		Practical -VIA Organic Preparation & Estimation.	3	10	40	50	3
6	Core:5.6B Chemistry Code:16SEB-76	VI-B	Chemistry elective	3	20	80	100	4
	Che Practical:5.6B		Practical -VIB Chemistry-elective experiments.	3	10	40	50	3
7	Core:6.7 Chemistry Code:16SF-76	VII	Modern concept of Chemistry -II	3	20	80	100	3
	Che Practical:6.7		Practical -VII Physical chemistry Experiments. (Electrical & Instrumental)	3	10	40	50	3
8	Core:6.8 Chemistry Code:16SFF-76	VIII	Applied Chemistry -II	3	20	80	100	3
	Che Practical:6.8		Practical -VIII Analytical Method	3	10	40	50	3
TOTAL				287 4P	240	960	1200	52

BoS members

1 B. S. Ushak

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