



VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

JNANASAGARA CAMPUS, BALLARI-583105

**Department of Studies in
Chemistry**

II Semester Syllabus

Bachelor of Science

With effect from 2021-22 and onwards

Semester-II

DSC 2 : Models and Concepts in Chemistry

Course Title: Models and Concepts in Chemistry	Course code: 21BSC2C2MCL
Total Contact Hours: 56	Course Credits: 04
Internal Assessment Marks: 40	Duration of SEE: 03 Hours
Semester End Examination Marks: 60	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. To develop an understanding of the periodic trends among the compounds of s and p-block elements
2. The concepts of Organic reactions and techniques of writing the movement of electrons, bond breaking, bond forming
3. Understand the preparation of alkanes, alkenes and alkynes, their reactions, etc.
4. To make familiarization with various states of matter
5. To familiarize the student with nucleophilic and electrophilic substitution reactions in aliphatic and aromatic compounds
6. To teach calculation of lattice parameters
7. To develop the concept of solids, lattice parameters – its calculation, application of symmetry and solid characteristics of simple salts
8. Treatment of analytical data using statistics

DSC 2: Models and Concepts in Chemistry

Unit	Description	Hours
1	Trends in Periodic properties: s, p, d and f-block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block elements: (a) Atomic radii (van der Waals) (b) Ionic and crystal radii. (c) Covalent radii (d) Ionization enthalpy, successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (e) Electron gain enthalpy, trends of electron gain enthalpy. (f) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-	12

	Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Trends in the chemistry of the compounds of groups 13 to 17 (hydrides, carbides, oxides and halides) are to be discussed.	
2	Mechanisms of Organic Reactions Notations used to represent electron movements and directions of reactions- curly arrows, formal charges. Types of bonds breaking- homolytic and heterolytic. Types of reagents-Electrophiles, nucleophiles, nucleophilicity and basicity. Types of organic reactions- substitution, addition, elimination, rearrangement and pericyclic reactions, explanation with examples. Chemistry of Aliphatic hydrocarbons, Carbon-Carbon Sigma bonds Chemistry of alkanes: Formation of alkanes, Wurtz reaction, Wurtz-Fittig reaction, Free radical substitution, Halogenation- relative reactivity and selectivity	10
3	Substitution reactions: Nucleophilic substitution at saturated carbon. Mechanism of 1S_N and 2S_N reactions with suitable examples. Energy profile diagrams, Stereochemistry and factors effecting 1S_N and 2S_N reactions. Aromatic Electrophilic substitution reactions, Mechanisms, σ and π complexes, Halogenation, Nitration, Sulphonation, Friedel Crafts alkylation and acylation with their mechanism. Activating and deactivating groups. Orientation influence, Ortho-para ratio. Aromatic nucleophilic substitution reaction: S_N^{Ar} and Benzyne mechanism with suitable examples	10
4	Liquid Crystals Explanation, classification with examples- Smetic, nematic, cholesteric, discs shaped and polymeric. Structures of nematic and cholesteric phases- molecular arrangements in nematic and cholesteric liquid crystals. Applications of liquid crystals in LCDs and thermal sensing. Solids Forms of solids: Unit cell and space lattice, anisotropy of crystals, size and shape of crystals, Laws of Crystallography: Law of constancy of interfacial angles, Law of rational indices, Law of symmetry (Symmetry elements), Crystal systems, Bravais lattice types and identification of lattice planes. Miller indices and its calculation, X-Ray diffraction by crystals: Bragg's law and derivation of Bragg's equation, Single crystal and powder diffraction methods. Defects in crystals, glasses and liquid crystals. Numerical problems. Distribution Law Nernst Distribution Law - Statement and its derivation. Distribution constant, factors affecting distribution constant, validity of Distribution Law, Modification of distribution law when molecules undergo a) Association b) Dissociation. Application of Distribution Law in Solvent extraction. Derivation for simple and multiple extraction. Principles of distribution law in Parkes Process of desilverisation of lead. Numerical Problems.	12

5	<p>Treatment of Analytical Data: Language of analytical chemistry: Definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques. Choice of an analytical method - accuracy, precision, sensitivity, selectivity, method validation. Figures of merit of analytical methods and limit of detection (LOD), Limit of quantification (LOQ), linear dynamic range (working range). Errors and treatment of analytical data: Limitations of analytical methods – Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finite samples -mean, median, range, standard deviation and variance. External standard calibration - regression equation (least squares method), correlation coefficient (R^2). Numerical problems</p>	12
<p>References:</p> <ol style="list-style-type: none"> 1. Basic Inorganic Chemistry, F A Cotton, G Wilkinson and P. L. Gaus, 3rd Edition. Wiley. India 2. Inorganic Chemistry, 2nd Edn. Catherine E. Housecroft and A.G. Sharpe, Pearson Prentice Hall(2005) 3. Concise Inorganic Chemistry: J D Lee, 4th Edn, Wiley, (2021) 4. Fundamentals Concepts of Inorganic Chemistry, Vol 1 and 2, 2nd Edition, Asim K Das, CBS Publishers and Distributors, (2013) 5. Morrison, R. N. & Boyd, R. N. <i>Organic Chemistry</i>, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education) 6. Finar, I. L. <i>Organic Chemistry (Volume I)</i>, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education) 7. McMurry, J. E. <i>Fundamentals of Organic Chemistry</i>, 7th Ed. Cengage Learning India Edition 2013 8. Organic Reaction mechanism by V. K. Ahluwalia and K. Parashar (Narosa Publishers). 9. Organic Chemistry by S. M. Mukherji, S. P. Singh and R. K. Kapoor. (Narosa Publishers) 10. A Guide book to mechanism in Organic Chemistry by Peter sykes. Pearson. 11. Atkins Physical Chemistry.8th Edition. Peter Atkins & Julio De Paula Oxford University Press. 12. Physical Chemistry by Samuel Glasstone, ELBS (1982). 13. A Text book of Physical Chemistry, A S Negi & S C Anand, New Age International Publishers (2007). 14. Principles of Physical Chemistry, Puri, Sharma & Pathania, Vishal Publishing Co. 15. A Text Book of Physical Chemistry P.L.Soni , O.P. Dharmarhaand and U.N.Dash, Sultan Chandand Sons. 16. Advanced Physical Chemistry, Gurdeep Raj, Goel Publishing House (2018) 17. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D.Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, Pearson Education Pvt.Ltd.(2007). 18. Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8th edition, Saunders College Publishing, New York (2005). 19. Analytical Chemistry, G.D. Christian, 6th edition, Wiley-India (2007). 20. Practical Volumetric Analysis, Peter A C McPherson, Royal Society of Chemistry, Cambridge, UK (2015). 		

DSC 2 : Chemistry Practicals-II

Course Title: Chemistry Practicals-II	Course code: 21BSC2C2MCP
Total Contact Hours: 56	Course Credits: 02
Internal Assessment Marks: 25	Duration of SEE: 03
Semester End Examination Marks: 25	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Conduct the simple synthesis and predict the mechanism of reactions
2. Able to apply the physical chemistry concepts for applications
3. Execute the experimental set up for routine environmental analysis
4. Understand the importance of environmental monitoring and analysis

DSC 2 : Chemistry Practicals-II

List of Experiments

1. Hydrolysis of methyl m-nitrobenzoate to m-nitrobenzoic acid (Conventional method)
2. Synthesis of diazoaminobenzene from aniline (conventional method).
3. Preparation of dibenzalacetone (Green method).
4. Diels Alder reaction between furan and maleic acid (Green method).
5. Determination of specific and molar refraction by Abbes Refractometer. (Ethylacetate, Methyl acetate, Ethylene Chloride)
6. Determination of the composition of liquid mixture by refractometry. (Toluene & Alcohol, Water & Sucrose)
7. Determination of partition/distribution coefficient - i) Acetic acid in water and cyclohexane. ii) Acetic acid in Water and Butanol. iii) Benzoic acid in water and toluene.
8. Determination of carbonate and hydroxide present in a mixture.
9. Determination of oxalic acid and sodium oxalate in a given mixture using standard $\text{KMnO}_4/\text{NaOH}$ solution
10. Standardization of potassium permanganate solution and determination of nitrite in a water sample
11. Standardization of silver nitrate and determination of chloride in a water sample (demonstration)
12. Determination of alkali content in antacids
13. Determination of chlorine in bleaching powder using iodometric method.
14. Determination of Ba^{2+} as BaSO_4 (GRAVIMETRY)
15. Determination of Cu^{2+} as CuSCN (GRAVIMETRY)

References:

1. Vogel's Textbook of Quantitative Chemical Analysis, 2nd or 3rd edition, ELBS
2. Practical Volumetric Analysis, Peter A C McPherson, Royal Society of Chemistry, Cambridge, UK (2015).
3. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
4. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012) .
5. Monograph on Green Chemistry Laboratory Experiments DST. Govt of India.
6. *Practical Physical Chemistry*, B.D. Khosla, V.C Garg & Adarsh Gulati, R.Chand & Co.: New Delhi (2011)
7. *Experiments in Physical Chemistry 8th Ed.*; C W Garland, J W Nibler & D P Shoemaker, McGraw-Hill: New York (2003)
8. <https://www.lccc.edu/academics/science-and-engineering/science-in-motion/labs-equipment/chemistry-lab-experiments>
9. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
10. Green Chemistry by V. K. Ahluwalia. Narosa Publishing House Pvt. Ltd. 2012 .
11. *Advanced Practical Physical Chemistry*, J.B. Yadav, GOEL Publishing house (2017).
12. *Practical Physical Chemistry*, B.Viswanathan & P.S.Raghavan, Viva Books Pvt. Ltd (2017).

OEC 2 : Molecules of Life

Course Title: Molecules of Life	Course code: 21BSC2O2CH2
Total Contact Hours: 42	Course Credits: 03
Internal Assessment Marks: 40	Duration of SEE: 03
Semester End Examination Marks: 60	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Acquire knowledge about different types of sugars and their chemical structures
2. Identify types of amino acids and peptides.
3. Explain the enzyme actions in our body and their inhibition
4. Predict action of drugs.
5. Depict the importance of lipids in the metabolism
6. Differentiate RNA and DNA and their replication.
7. Explain production of energy in our body..

OEC 2 : Molecules of Life

Unit	Description	Hours
1	Carbohydrates Classification of carbohydrates, reducing and non-reducing sugars, General properties of glucose and fructose, their open chain structures. Epimers, mutarotation and anomers. Linkage between monosaccharides, structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.	8
2	Amino Acids, Peptides and Proteins Classification of amino acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of peptides. Importance of proteins in growth and life sustainment.	8

3	<p>Enzymes and correlation with drug action Mechanism of enzyme action, factors affecting enzyme action, Co-enzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Non competitive inhibition including allosteric inhibition).</p> <p>Drug action-receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group, -NH₂ group, double bond and aromatic ring</p>	10
4	<p>Nucleic Acids Components of nucleic acids: Adenine, guanine, thymine and cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.</p> <p>Lipids Introduction to lipids, classification. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).</p>	8
5	<p>Concept of Energy in Biosystems Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate- Glycolysis, Fermentation, Krebs Cycle. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates.</p>	8
<p>References</p> <ol style="list-style-type: none"> Morrison, R. T. & Boyd, R. N. <i>Organic Chemistry</i>, Dorling Kindersley (India) Pvt. Ltd.(Pearson Education). Finar, I. L. <i>Organic Chemistry (Volume 1)</i>, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Finar, I. L. <i>Organic Chemistry (Volume 2)</i>, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Nelson, D. L. & Cox, M. M. <i>Lehninger's Principles of Biochemistry 7th Ed.</i>, W. H. Freeman. Berg, J.M., Tymoczko, J.L. & Stryer, L. <i>Biochemistry</i>, , 2002. 		

CBCS Question Paper Pattern for UG Semester End
Examination with effect from the AY 2021-22

Discipline Core Courses (DSC) & Open Elective Courses
(OEC)

Paper Code:

Paper Title:

Time: 3 Hours

Max. Marks: 60

Instruction: Answer all Sections

SECTION-A

1. Answer the following sub-questions, each sub-question carries **ONE** mark.

(10X1=10) a).

b).

c).

.

.

j).

Note for Section-A: Two sub-questions from each unit.

SECTION-B

Answer any **FOUR** of the following questions, each question carries FIVE marks.

(4X5=20)

0)2.

3.

4.

5.

6.

7.

Note for Section-B: Minimum One question from each unit (Q No 2 to 6) and remaining one question from unit II to V (Q.No. 7)

SECTION-C

Answer any **THREE** of the following questions, each question carries TEN marks.

(3X10=30)

30)8.

9.

10.

11.

12.

Note for Section- C: One question from each unit. Sub-questions such as ‘a’ and ‘b’ may be given for a question in section-C only.

SEC & AECC Subjects

Paper Code:

Paper Title:

Time: 1 Hours

Max. Marks: 30

There shall be Theory examinations of **Multiple Choice Based Questions [MCQs]**with Question Paper of **A, B, C and D Series** at the end of each semester for **AECCs (Environmental Studies and (ii) Constitution of India)** and **SECs (SEC-1: Digital Fluency, SEC-2: Artificial Intelligence, SEC-3: Cyber Security and SEC-4: Societal Communication)** for the duration of One hour (First Fifteen Minutes for the Readiness of OMR and remaining Forty- Five Minutes for Answering thirty Questions). The Answer Paper is of OMR (Optical Mark Reader) Sheet.

Scheme of Evaluation for UG Chemistry Practicals :

Marks for Practical End Semester Examination: 25

Duration of Examination: 3 h

One experiment may be conducted for the end semester examination. Scheme

of Marks distribution:

1) Execution of the experiment: 15 marks
(Includes design, execution, graph, calculation and reporting (including observation))

2) Mechanism/accuracy/chemical reaction/
Interpretation of the results: 05 marks

3) Viva-voce:

05 marks

Total Marks: 25 marks