**Dept Name: Dept. of Studies in Computer Science**
**Semester-II**
**DSC6P5 : Python Programming Lab**

| Course Title: Python Programming Lab | Course code: 21CSC2C6P |
|---|---|
| Teaching Hours/Week (L-T-P): 0 - 0 – 4 | Course Credits: 02 |
| Formative Assessment Marks: 20 | Duration of ESA/Exam: 04 hrs. |
| Summative Assessment Marks: 30 | |

**Course Outcomes (COs):**
**At the end of the course, students will be able to:**

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops.
3. Use functions for structuring Python programs.
4. Represent compound data using Python lists, tuples, dictionaries

**Python Laboratory**

1. Compute the GCD of two numbers.
2. Find the square root of a number. (Newton's method)
3. Exponentiation. (power of a number)
4. Find the maximum of a list of numbers.
5. Linear search and Binary search.
6. Selection sort, Insertion sort.
7. How to create, slice, change, delete and index elements using Tuple.
8. Find first n prime numbers.
9. How to create, slice, change, add, delete and index elements using list.
10. Programs that take command line arguments (word count)
11. Write a program to reverse the string.
12. How to change, delete, add and remove elements in Dictionary.
13. Find the most frequent words in a text read from a file.
14. Simulate elliptical orbits in Pygame.
15. Simulate bouncing ball using Pygame.

**Dept Name: Dept. of Studies in Computer Science**
**Semester-II**
**DSC7P6: Mini Project based on DBMS & Software Engineering**

| | |
|---|---|
| Course Title: Mini Project based on DBMS & Software Engineering | Course code: 21CSC2C7P |
| Teaching Hours/Week (L-T-P): 0 - 0 - 4 | Course Credits: 02 |
| Formative Assessment Marks: 20 | Duration of ESA/Exam: 04 hrs. |
| Summative Assessment Marks: 30 | |

**Course Outcomes (COs):**

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

1. Apply the knowledge of database management system development process and conduct the experiments using SQL queries to find the solution for given database problem.
2. Apply the knowledge of Software Engineering concepts like SDLC model, UML Concepts, Software Design, Testing for the development of applications.
3. Analyze and design solutions for Database system components to meet the specified needs of online transaction processing and information systems like Banking systems, Ticket Reservation systems etc..
4. Develop code for stored programs, triggers assertions and to generate reports.
5. Contribute to the team as a member, lead the team

Develop a Software Application with database connectivity with which you are familiar (Eg. Library Database, Employee Database, Student Database, Inventory database etc…). Also apply the concepts of Software Engineering during the development of an application.
Perform the following assuming a Relational Database Management System:

1. List the set of requirements
2. Identify the following:
   a. Entities and attributes
   b. Entity Types, Entity Sets, keys and Value Sets.
   c. Relationship types, Relationship Degree and Recursive Relationships.
   d. Relationship Constraints: Cardinality Ratio and Participation.
   e. Attributes of Relationship Types.
   f. Weak Entity Types.
3. Design an ER Diagram.
4. Draw the UML diagram.
5. Draw the Schema Diagram with Referential Integrity Constraints.
6. Design Test Cases.
7. Normalize the table.
8. Create the database.
9. Insert suitable records in your database.
10. Execute any five typical queries on your database.
11. Generate any three typical reports on your database.
12. Write any three stored procedures on your database.

**Guidelines**:

- Group work: [Not more than 2 members in a group]

- Group has to chose any familiar database (DB) application
- Activities should be performed during lab hours.

**Dept Name: Dept. of Studies in Computer Science**
**Semester-II**
**SEC2: Advanced Web Programming**

| Course Title: Advanced Web Programming | Course code: 21CSC2S2 |
|---|---|
| Teaching Hours/Week (L-T-P): 0 - 0 - 2 | Course Credits: 02 |
| Formative Assessment Marks: 20 | Duration of ESA/Exam: 01 hrs. |
| Summative Assessment Marks: 30 | |

**Course Outcomes (COs):**

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

1. Design and develop dynamic web pages with good aesthetic sense of designing.
2. Understand the concepts of Web Application Terminologies, Internet Tools other Web services.
3. Design and develop pages using the JavaScript, XML, CSS, PHP.

**Advanced Web Programming Laboratory**

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10and outputs HTML text that displays the resulting values in an HTML table format.
3. Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays “TEXT-SHRINKING” in BLUE color. Then the font size decreases to 5pt.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems:
    a. Parameter: A string
    b. Output: The position in the string of the left-most vowel
    c. Parameter: A number
    d. Output: The number with its digits in the reverse order
5. Design an XML document to store information about a student admission to computer science department, VSKUB. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3students. Create a CSS style sheet and use it to display the document.
6. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.

7. Write a PHP program to display a digital clock which displays the current time of the server.
8. Write the PHP programs to do the following:
    a) Implement simple calculator operations.
    b) Find the transpose of a matrix.
    c) Multiplication of two matrices.
    d) Addition of two matrices.
9. Write a PHP program to sort the student records which are stored in the database using selection sort.

# CBCS Question Paper Pattern for PG Semester End Examination with Effect from the AY 2021-22

## Disciplines Specific Core (DSC) and Discipline Specific Elective (DSE)

**Paper Code:** **Paper Title:**

**Time: 3 Hours** **Max. Marks: 70**

**Note: Answer any *FIVE* of the following questions with Question No. 1 (Q1) Compulsory, each question carries equal marks.**

Q1. 14 Marks

Q2. 14 Marks

Q3. 14 Marks

Q4. 14 Marks

Q5. 14 Marks

**Note: Question No.1 to 5, *one question from each unit* i.e. (Unit I, Unit II, ….). The Questions may be a whole or it may consists of sub questions such as a,b, c etc…**

Q6. 14 Marks

**Note: Question No.6, *shall be from Unit II and III,* the Question may be a whole or it may consists of sub questions such as a,b, c etc…**

Q7. 14 Marks

**Note: Question No.7*, shall be from Unit IV and V*, the Question may be a whole or it may consists of sub questions such as a,b, c etc…**

Q8. 14 Marks

**Note: Question No-8 shall be from *Unit II, Unit III , Unit IV and Unit V*. The question shall have the following sub questions and weightage. i.e a – 05 marks, b – 05 marks, c – 04 marks.**

**********

## Skill Enhancement Courses (SECs)

**Paper Code:** **Paper Title:**

**Time: 1 Hours** **Max. Marks: 30**

**There shall be Theory examinations of Multiple Choice Based Questions [MCQs] with Question Paper set of A, B, C and D Series at the end of each semester for SECs for the duration of One hour (First Fifteen Minutes for the Preparation of OMR and remaining Forty-Five Minutes for Answering thirty Questions). The Answer Paper is of OMR (Optical Mark Reader) Sheet.**

**********

## Question Paper Pattern for Subjects with Tutorial

**For the subjects with Tutorial component, there is no Semester-End Examination (SEE) to the component C3. The liberty of assessment of C3 is with the concerned faculty. The faculty must present innovative method of evaluation of component C3 before the respective BoS for approval and the same must be submitted to the Registrar and Registrar (Evaluation) before the commencement of the academic year.**

**********

**VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY**
**JNANASAGARA CAMPUS, BALLARI-583105**

# Department of Studies in

# INDUSTRIAL CHEMISTRY

# SYLLABUS

Master of Science
(II Semester)

With effect from
2021-22

| Semester No. | Category | Subject code | Title of the Paper | Marks | | | Teaching hours/week | | | Credit | Duration of exams (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | IA | Sem. Exam | Total | L | T | P | | |
| SECOND | DSC5 | 21 ICH2C5L | Coordination Chemistry | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSC6 | 21 ICH2C6L | Chemistry of Natural products, Reagents in Organic synthesis and Heterocyclic Compounds | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSC7 | 21 ICH2C7L | Electro and Photochemistry | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | DSC8 | 21 ICH2C8L | Instrumental methods of analysis | 30 | 70 | 100 | 4 | - | - | 4 | 3 |
| | SEC2 | 21 ICH2 S2 P | Research Methodology | 20 | 30 | 50 | 1 | - | 2 | 2 | 1 |
| | DSC 5P | 21 ICH2 C4 P | Synthesis of Coordination compounds | 20 | 30 | 50 | - | - | 4 | 2 | 4 |
| | DSC6P | 21 ICH2 C5 P | Organic synthesis | 20 | 30 | 50 | - | - | 4 | 2 | 4 |
| | DSC7P | 21 ICH2 C6 P | Instrumental methods of analysis | 20 | 30 | 50 | - | - | 4 | 2 | 4 |
| **Total Marks for II Semester** | | | | | | **600** | | | | **24** | |

**Dept Name: Industrial Chemistry**
**Semester-II**
**DSC5: Coordination Chemistry**

| | |
|---|---|
| **Course Title**: Coordination Chemistry | **Course code:** 21 ICH2 C5 L |
| **Total Contact Hours**: 56 | **Course Credits:** 04 |
| **Formative Assessment Marks:** 30 | **Duration of ESA/Exam:** 03 |
| **Summative Assessment Marks:** 70 | |

**Course Objective:** The objective of this course is to prepare the students to get acquainted with thorough knowledge in coordination chemistry and bioinorganic chemistry. The students will also get information about the usefulness of nuclear chemistry in various fields.

**Course Outcomes:** At the end of the course the student would be able to,

1. Describe the bonding in transition metal complexes using crystal field and ligand field theories and the 18 electron rule.
2. Describe various metal-ligand interactions in terms of sigma- and pi-bonding interactions.
3. Explain the stability of d-metal complexes, their reactivity, and the mechanisms of ligand substitution reactions.
4. Mention the important applications of metal chelates.
5. Explain magnetic susceptibility and its importance in predicting the geometry of the complexes..
6. Characterize the complexes using Orgel and TS diagrams.
7. define the importance of inorganic elements in vital systems.
8. Explain the importance of minerals for living organisms.
9. Interpret situations that may occur in the absence and excess of minerals.
10 Explain Metal ion binding to biomolecules and their function
11. Recognize and use the symbols for protons, neutrons, electrons, positrons, alpha particles, beta particles, and gamma rays.
12. Compare the penetrating power of alpha, beta, neutron, and gamma radiation.
13. Understand and calculate the mass defect for a nuclear reaction use Einstein's relation, $E = (\Delta m)c^{2}$.
14. Calculate energy changes in nuclear reactions calculate nuclear binding energies
14. Interpret binding energy per nucleon plots in terms of nuclear stability and the energy changes associated with fission and fusion reactions.
15. Explain the analytical applications and the biological effects of radiation:
16. Interpret the data to calculate the age of an object (radiochemical datin

## DSC5: Coordination Chemistry

| Unit | Description | Hours |
|---|---|---|
| **Unit I** | **Bonding in Metal complexes**<br>**Metal-Ligand Bonding:**<br>Concept of effective atomic number, electronic configuration of metal complexes by VBT, draw backs of VBT.<br>Crystal Field Theory(CFT)-salient features, crystal field splitting of d orbitals in octahedral, tetrahedral, tetragonal and squarer planar fields Magnitude of Δ, factors affecting Δ, crystal field stabilization energy (CFSE), effects of crystal field splitting, energy of ligation, stabilities of oxidation states Co(III).<br>Spectrochemical series, nephelauxetic series, short comings of CFT, evidences for covalence, John-Teller distortion in metal complexes and metal chelates. M.O treatment of coordination compounds involving σ and π bonding. | **10 hrs** |
| **Unit II** | **Magnetic and Spectral Properties of Coordination Compounds**<br>**Magnetic properties of coordination compounds**<br>Types of magnetic behaviour, magnetic susceptibility and its determination- Gouy, Faraday, VSM method. Diamagnetic correction, orbital contribution, spin-orbital coupling, ferro- and antiferromagnetic coupling, spincrossover.<br>Magnetic properties of Lanthanide and Actinide metal complexes.<br>**Electronic spectra of coordination compounds-** Spectroscopic ground states, selection rules, term symbols for $d^n$ ions, Racah parameters, Orgel, Correlation and Tanaube-Sugano diagrams, spectra of 3d metal-aqua complexes of trivalent V, Cr, divalent Mn, Co and Ni, $[CoCl_4]^{2-}$ calculation of Dq, B and β parameters, CT spectra.<br>Spectral properties of Lanthanide and Actinide metal complexes. | **13 hrs** |
| **Unit III** | **Reaction mechanism of Transition Metal Complexes**<br>**Metal-Ligand Equilibria in Solution:**<br>Step-wise and over-all formation constant and their relationships, 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 and macro cyclic effects and their thermodynamic origin, determination of binary formation constants by pH meter, spectrophotometry,.<br>**Kinetics and Mechanism of Reactions of Coordination Compounds:**<br>Introduction, inert and labile complexes. Mechanism of substitution reactions, classification of ligand substitution reactions in octahedral and square planar complexes, molecular rearrangements of four and six coordinated complexes. | |

| | | |
|---|---|---|
| | **Electron Transfer Reactions (Redox Reactions):**<br>Inner and outer sphere mechanisms, one electron, two electron, complimentary and non complimentary electron-transfer reactions | **10 hrs** |
| **Unit IV** | **Bio-lnorganic Chemistry**<br><br>Metal Ions in Biological Systems Essential and types metals<br>Na+/K+ transport across cell membranes, ionophores, crown ethers, Na+/K+ pump. Iron storage and transfer- ferritin, transferrin and siderophores.<br>Oxygen transport and oxygen uptake proteins- transport and storage of dioxygen; Heme proteins and oxygen uptake, structure and functions of haemoglobin and myoglobin, dioxygen binding,<br>Bohr effect, Hill equation, role of distal and proximal histidine; Model complexes for dioxygen binding, non- porphyrin systems- hemerythrin and hemocyanin.<br>Photosynthesis and nitrogen fixation: Nitrogenase: structural aspects and functions, abiological nitrogen fixation. Photosynthesis: Chlorophyll- structural features, role of Mg2+- Z scheme of photosynthesis-PSI and PSII | **10 hrs** |
| **Unit V** | . **Nuclear Chemistry**<br><br>Nuclear Stability – Mass Defect and Binding Energy..<br>Radioactivity: Radioactive elements, general characteristics of radioactive decay, interaction of $\alpha$, $\beta$ and $\gamma$ – rays with matter. Nuclear reactions Types of nuclear reactions, Nuclear fission<br>**Applications of Radioactivity:** Synthesis of various useful isotopes, use of isotopes in the elucidation of reaction mechanism, structure determination, kinetics of exchange reactions, measurement of physical constants including the diffusion constants, isotope dilution techniques, NAA, PGNAA, neutron absoptiometry and age determination, radio isotopes in field of medicine | **12 hrs** |

**References:**

1. J. E. Huheey, E. A. Keiter and R.L. Keiter, Inorganic Chemistry, Principles of Structure and Reactivity, Pearson Education, 2004.
2. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Advanced

Inorganic Chemistry, John Wiley & Sons, Inc., New York, 2009.
3. J. D. Lee, Concise Inorganic Chemistry, Blackwell Science, Oxford, 2000.
4. P. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, Shriver & Atkins:Inorganic Chemistry, Fourth edition, Oxford University Press, Oxford, 2000.
5. F. A. Carey G. Wilkinson, C. A. Murillo and M. Bochmann, Advanced Inorganic Chemistry, Wiley Interscience, 2003. 11
6. C. E. Housecroft and A. G. Sharpe, Inorganic Chemistry, Prentice Hall, 2005.
7.. R. M. Roat-Malone, Bioinorganic Chemistry – A Short Course, John Wiley & Sons, Inc., Hoboken, New Jersey, 2007.
8. S. J. Lippard, and J. M. Berg, Principles of Bioinorganic Chemistry, Univ. Science Books, 1994.
9. W. Kaim and B. Schwederski, Bioinorganic chemistry: Inorganic Elements in the Chemistry of Life – An Introduction and Guide, John Wiley & Sons, 1994.
10. Principles of Bioinorganic Chemistry by S. J. Lippard and J. M. Berg, Panima Publishing Corporation, 1stEdn.
11. G. Choppin, J. Rydberg and J. O. Liljenzin, Radiochemistry and Nuclear Chemistry, Butterworth-Heinemann, 3rd Edition, 2002.
12. W. D. Loveland, D. Morrissey and G. T. Seaborg, Modern Nuclear Chemistry, John Wiley & Sons, 2006.
13. Irving Kaplan, Nuclear Physics 2nd Edition Addison-Wesley Publishing Company
14. Inorganic Electronic spectroscopy, A. B. P. Lever, Elsevier. (1968).
15. Magnetochemistry, R.L. Carlin, Springer Verlag.
16. Electronic Absorption Spectroscopy and related Techniques, D. N. Sathyanarayana, University Press (2001).
17. Inorganic Chemistry A Unified Approach by W. W. Porterfield, Elsevier 2005 2nd edition.

Date Course Coordinator Subject Committee Chairperson

**DSC6: Chemistry of Natural products, Reagents in Organic synthesis and Heterocyclic compounds**

| | |
|---|---|
| **Course Title:** Chemistry of Natural products, Reagents in Organic synthesis and Heterocyclic compounds | **Course code**: 21 ICH2 C6 L |
| **Total Contact Hours:** 56 | **Course Credits:** 04 |
| **Formative Assessment Marks:** 30 | **Duration of ESA/Exam:** 03 |
| **Summative Assessment Marks:** 70 | |

**Course Objective:** The objective of this course is to make the students to acquire important information regarding various organic compounds in nature which are part of our daily lives. Also, this course would impart knowledge about importance of heterocyclic compounds. Various reagents used in organic synthesis and applications of photochemistry to it.

.

**Course Outcomes:** At the end of the course the student would be able to,

1. Explain different types of alkaloids, glycosides & terpenes etc and their chemistry and medicinal importance.
2. Learn the constituent present in crude drugs responsible for metabolic activities.
3. Explain the structure and properties of carbohydrates
4. Describe the reducing action of sugars.
5. Combine the structure and functions of lipids
6. Identify the structure of aminoacids
7. Classify proteins with functions illustrating the structures.
8. Describe the structure and functions of RNA and DNA
9. Describe the classification of heterocyclic compounds according to their different types Showing the multiple methods of preparation of heterocyclic compounds
10. Recognize the chemical properties of heterocyclic compounds and their reaction mechanisms.
11. Demonstrate an understanding of excited states and apply group theory to photochemical problems
12. Describe and apply photochemical reactions of certain homologous series of organic compounds

**DSC6: Chemistry of Natural products, Reagents in Organic synthesis and Heterocyclic compounds**

| Unit | Description | Hours |
|---|---|---|
| **Unit-I** | **Chemistry of Natural products**<br><br>**Alkaloids Terpenoids and steroids.**<br>**Alkaloids** – classifications occurrence, general methods of structural elucidation, stereo Chemistry and synthesis of quinine, papareine, morphine.<br>**Terpenoids** – occurrence general methods of structural elucidation, stereo Chemistry and synthesis of following representative molecules-citral, camphor and santonin.<br>**Steroids** – cholesterol, ergo sterol-structure and synthesis. | **11hrs** |
| **Unit-II** | **Carbohydrates, Proteins and Nucleic acids**<br>**Carbohydrates**-Determination of ring structures of monosaccharide and disaccharides with reference to glucose, fructose, maltose and sucrose.<br>**Proteins** – Amino acids, peptides, peptide synthesis using blocking reagents, modern methods of peptide synthesis. Structure of proteins – primary. secondary & tertiary structure, sequence of amino acids in proteins, end group analysis.<br>**Nucleic acids**- chemical and enzymatic hydrolysis of nucleic acids, purine & pyrimidine bases, double helix of DNA, base pairing via H-bonding, various types of RNA & their functions. | **11hrs** |
| **Unit-III** | **Heterocyclic Compounds**<br><br>**Heterocyclic Chemistry:**<br>IUPAC nomenclature of heterocyclic ring systems (3-7 memberd rings and simple fused systems) comparative aromaticity of pyrrole, furon, thiophene, pyridine. Methods of synthesis, electorphilic and nucleophilic substitutions reactions of pyrrole, furon, thiophene, pyridine ring systems. Compression of basecity of pyridine, piperidine and pyrrole.<br>Fused heterocycles of 6 & 5 memberd rings-synthesis and reactions of indole, benzofurn, quinoline, isoquinoline with special references to Fischer indole synthesis, and Skraup synthesis, Bischler-Napier Laski synthesis, mechanism of electorphilic substitution reaction of indole, quinoline and benzofurn | **12 hours** |

| | | |
|---|---|---|
| **Unit-IV** | **Reagents in Organic synthesis and their uses**<br>Use of following reagents in organic synthesis and functional group transformation<br>i) Dicyclohexylcarbodiimide (DCC) ii) Tri-n-butyltin hydride<br>iii) Wood ward and Pre Vost hydroxylation iv) Osmium tetroxide<br>v) DDQ vi) Selinium dioxide<br>vii) Phase transfer catalysis viii) Crown ethers<br>ix) Merrifield resin x) Peterson's synthesis<br>, Carbonyls and Aromatic compounds. Miscellaneous photochemical reactions. | **12hrs** |
| **Unit-V** | **Organic Photochemistry**<br><br>Concepts in Organic photochemistry- forbidden transitions, excited states, types of excitations, Frank-Condon principle. Chemical processes in excited molecules, hydrogen abstraction, cleavage of radicals, intra-molecular rearrangements, photo-isomerisation, photo-dimerisation and photo-sensitisation. Determination of reaction mechanisms. Photochemistry of Alkenes, Carbonyls and Aromatic compounds. Miscellaneous photochemical reactions | **11hrs** |

**References:**


1. Natural Products Vol.I & II by O.P. Agarwal Goel publications – Meerut.
2. Burger's Medicinal Chemistry, M.E. – Wolff, Ed., John Wiley & Sons, New York
3. Chemistry of Natural Products, 1st Edition, S. V. Bhat, B. A. Nagasampagi and M. Sivakumar, 2008, Narosa Publishing House
4. Organic Chemistry, Vol.II by I.L. Finar, The English Language Book Society, London
5. Organic Chemistry-P.Y.Bruice (Pearson Education Pvt. Ltd., New Delhi),2002.
6. Organic Chemistry-Vol. -1,2 &3- Mukherji, Singh and Kapoor. (Wiley Eastern,) 1994.
8. Organic Chemistry-3rd Edn- F.A. Carey (Tata McGraw Hill, New Delhi) 1996
9. Organic Chemistry-R.T. Morrison and R.N. Boyd (Prentice Hall, New Delhi) 1994.
10. Organic Chemistry 4th Edn.–S.H. Pine et al (McGraw-Hill, London) 1987.
11. Advanced Organic Chemistry- R.A. Carey and R.J. Sundberg (Plenum, New York)1990.
12. Modern Concepts of Advanced Organic Chemistry-R.P. Narein (Vikas, Delhi) 1997.
13. A Text book of Organic Chemistry-Tewari, Vishnoi and Mehrotra (Vikas, New Delhi)1998.
14. A Text book of Organic Chemistry-3rd Edn.-R.K. Bansal, (New Age, New Delhi) 1997.
15. R. M. Acheson, An Introduction to the Chemistry of Heterocyclic Compounds, Interscience NY
16. Chemistry of Natural Products: A Unified Approach, N.R. Krishnaswamy, University Press (India) Ltd., Orient Longman Limited, Hyderabad, 1999. (Overall and for certain

aspects of, azadirachtin, morphine, reserpine,).
17. Introduction to Organic Chemistry, A Streitweiser, CH Heathcock and E.M/ Kosover IV Eeition, Me.Milan, 1992
18. Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall

Date Course Coordinator Subject Committee Chairperson

## DSC 7: Electro, Quantum and Photochemistry

| | |
|---|---|
| **Course Title**: Electro, Quantum and Photochemistry | **Course code**: 21 ICH2 C7 L |
| **Total Contact Hours:** 56 | **Course Credits:** 02 |
| **Formative Assessment Marks:** 20 | **Duration of ESA/Exam:** 03 |
| **Summative Assessment Marks:** 30 | |

**Course Objective:** A study of physical chemistry aspects related to the electrochemistry, quantum chemistry and photochemistry in the second semester should give the essential information on the topics of reversible and irreversible electrode process, electro analytical techniques, aspects on quantum chemistry, photochemistry, symmetry and group theory.

**Course outcomes :**

At the end of the advanced physical chemistry course, student should be able to

1. Differentiate between reversible and irreversible electrochemical process.
2. List the types of overvoltage and determine the overvoltage
3. Explain the theory and principles of polarography
4. Summerize the equations related to electrokinatic phenomenon
5. Estimate the quantum yields in the photochemical reaction
6. Explain the working principle of actinometers
7. Predict entropy of translational function.
8. Understand the statistical theories of thermodynamics
9. Describe the wave-particle duality
10 Apply schorodinger wave equation to one dimensional and three dimensional box.
11. Validate quantum chemistry with experimental observations
12. Demonstrate symmetry operations
13. Construct the character table
14. Apply group theory for Determination of vibration modes, hybridization, molecular orbitals

## DSC7: Electro, Quantum and Photochemistry

| Unit | Description | Hours |
|---|---|---|
| **Unit-I** | Electrokinetic Phenomena<br><br>Introduction, reversible and irreversible electrodes. Polarization, Ohmic overvoltage, concentration overvoltage, activation overvoltage. Hydrogen over voltage and oxygen over voltage. Effect of temperature, current density and pH on over voltage. Experimental determination of over voltage. Equations for concentration over potential, diffusion current, stationary current, potential curves, thickness of diffusion layer, diffusion controlled current potential curves at a dropping mercury electrode, polarography, half wave potential, application in qualitative and quantitative analysis. Energy barrier and electrode kinetics, Buttler-Volmer equation, Tafel equation | **12hrs** |
| **Unit-II** | **Photochemistry**<br>Introduction to photochemistry, quantum yield and its determination, factors affecting quantum yield, actinometry-uranyloxalate and potassium ferrioxalate actinometres, acetone and diethylketone actinometres. Term symbols and significance.<br>Photosensitization: by mercury, dissociation of $H_2$, photochemical kinetics of: decomposition of $CH_3CHO$, formation of HCl.<br>Photodegradation: photocatalyst-ZnO, $TiO_2$, principle, application of $ZnO/TiO_2$ in the photodegradation of dyes(IC), pesticides (DDT) and in industrial effluents. Effect of photodegradation on COD values | **10hrs** |
| **Unit-IV** | Statistical Thermodynamics-II<br><br>Sackur-Tetrode equation for entropy of translation function. Relation between equilibrium constant and partition function.<br>Different Distribution Laws:Types of Statistics : Maxwell – Boltzmann , Bose-Einstein and Fermi-Dirac statistics. Derivation of the equations for above three distribution Laws. Comparision of Bose-Einstein and Fermi-Dirac statistics with Maxwell – Boltzmann statistics. Problems and their Solutions.<br>Non-equillbrium Thermodynamics :<br>Thermodynamic criteria for non-equillibrium states-Phenomenological Laws and Onsager's reciprocity relations, Coupled and Non-coupled | |

| | | |
|---|---|---|
| | reactions, Entropy production and entropy flow. Postulates and methodologies: Uncompensated heat and thermodynamics function production. de- Donder's inequality. Rate of entropy production. Transformations of the generalized fluxes and forces : eg., Chemical reaction, heat flow, Diffusion or material flow, flow of electric current. | **11hrs** |
| **Unit-V** | **Symmetry and Group Theory** Symmetry elements & Symmetry operations, groups, subgroups, cyclic groups conjugate relationships, classes, molecular point groups, Schoenflies notations, matrix representations of symmetry operation, matrix representations of groups, Reducible and Irreducible representations, characters of representations, The great orthogonality theorem, character tables and their construction ($C_{2v}$, $C_{2h}$, $C_{3v}$)– Mullikan symbols, molecular models. Determination of vibration modes, hybridization, molecular orbitals on the basis of group theory | **11hrs** |


.**References:**Modern Electrochemistry, Vol I, IIA & IIB J.O.M. Bockries and A.K.N.Reddy (1998)

**2.** Electrochemistry,, Samuel Glasstone, East-West, New Delhi

3. Principles & Applications of Electrochemistry, D R Crow, 3rd Edn., Chapman & Hall,1987
4. Photochemistry, Carol E Wayne and Richard P Wayne, Oxford University Press, (1996)
5. Molecular Reactions and Photochemistry, C H Deputy and D S Chapman, Prentice Hall India, New Delhi ( 1st Edition) , 1972.
6. Concepts of Inorganic photochemistry, A. W. Adamson and P D Fleischaves Wiley
7. Quantum Chemistry, Ira N. Levine, 5th Edn., Prentice Hall of India Pvt. Ltd., 2006
8. Quantum Chemistry, A. B. Sannigrahi, 2nd Edn., Arunabha Sen Books and Allied Pvt. Ltd.,2010
9. Molecular Quantum Mechanics, P. W. Atkins, , Oxford University Press, New York, 2005.
10. Quantum Chemistry, Donald A McQuanie, Viva Books Pvt. Ltd., 2013
11. Thermodynamics for Chemists, S Glasstone, East-west Editon, New Delhi, 2003.
12. Chemical Thermodynamics-Basic Theory and Methods, 4th Edn., Klotz, Rosenbeg, Benjamin,1986
13. F. A. Cotton, *Chemical Applications of Group Theory*, Wiley Interscience, New York,2006.
14. P. H. Walton, *Beginning Group Theory for Chemistry*, Oxford University Press Inc., New York, 1998.
15. L. H. Hall, *Group Theory and Symmetry in Chemistry*, Mc Graw Hill, New York, 1969.
16. R. Mc Weeny, *Symmetry: An Introduction to Group Theory and its Applications,* Pergamon Press, London, 1963.

## DSC 8: Instrumental methods of analysis

| | |
|---|---|
| **Course Title**: Instrumental methods of analysis | **Course code**: 21 ICH2 C8 L |
| **Total Contact Hours:** 56 | **Course Credits**: 04 |
| **Formative Assessment Marks:** 30 | **Duration of ESA/Exam:** 03 |
| **Summative Assessment Marks:** 70 | |

**Course Objective:** A study of analytical chemistry aspects related to the chromatography, Electroanalytical and separation techniques ans X-Ray diffraction shall impart essential information on the topics which are very important and relevant.

**Course outcomes:**

At the end of the this course, students should be able to

1. Explain the basic principles of chromatography.
2. Classify the types of chromatography.
3. Define the basic parametres in chromatography.
4. categorize the types, basic components and properties of liquid chromatography. 5. 5. Describe the principles and working of GLC and HPLC along with their applications in pharmaceutical industries.
5. Describe the theory behind the technique of Atomic Absorption and Emission Spectroscopy
6. Identify and troubleshoot the interferences that occur during the analysis.
7. Decide about the suitable light source for the analysis.
8. Compare various current electroanalytical techniques
9. Comprehend the factors that must be controlled to obtain reliable and reproducible data from electroanalytical experiments.
10. Identify the most appropriate electroanalytical technique for a specific analysis
11. Interpret the data using current theoretical models
12. Describe the electrode reaction mechanism from data obtained using several electroanalytical techniques
13. Identify symmetry and space groups
14. Characterize the crystal using X-ray diffraction experiments
15. Analyze the collected experimental data•
16. Interpret the images of SEM and TEM.