ANDHRA UNIVERSITY

DEPARTMENT OF CHEMISTRY

PROGRAM : M.SC ORGANIC CHEMISTRY

REGULATION AND SYLLABUS

EFFECTIVE FROM 2020-2021 BATCH

ANDHRA UNIVERSITY
SCHOOL OF CHEMISTRY
DEPARTMENT OF ORGANIC CHEMISTRY& FDW
Revised Syllabus for Organic Chemistry Specialization
(With effect from the Admitted batch of 2021-2022 Academic Year)

PROGRAM OBJECTIVES:

1. To provide students in the scientific skills and chemical knowledge essential to develop and apply the knowledge in chemical sciences related to analysis of food and drug chemistry.
2. To provide knowledge, application, skills in water analysis
3. To equip students with effective scientific communication skills
4. To encourage the pursuit of lifelong education
5. To develop each student into a committed individual with ethical and social responsibility

PROGRAMME OUT COMES:

The Students Who Completes M.Sc Organic Chemistry Programs

PO1: Have strong foundations in the basic concepts of Organic Chemistry
PO2: Have good employment opportunities in pharmaceutical labs
PO3: Will get Jobs in various Chemical industries related to Pharma companies, polymer companies, pollution control boards etc.
PO4: Have excellent opportunities to pursue research
PO5: Can build their careers as Entrepreneurs by establishing "Start ups".
PO6: Have an opportunity to pursue career teaching in chemistry at various levels.

PROGRAMME SPECIFIC OBJECTIVES:

The students who complete the M.Sc. Chemistry (**Organic Chemistry Specialization**) course shall:

PSO1: Have strong foundation in the fundamentals and applications of chemical knowledge and understanding

PSO2: Have the abilities to think critically, logically and analytically and solve problem in the area of chemical sciences, drug chemistry, medicinal chemistry and water pollution

PSO3: Have the abilities to carry out chemical experiments, record and analyze the results and design advanced models

PSO4: Have the abilities to use modern library and information retrieving tools to obtain information and assimilate to generate concepts and apply them in challenging situations

PSO5: Have the abilities to effectively communicate their knowledge and skills to other chemists and non-chemists in oral or written formats.

PSO6: Secure suitable employment in the areas of chemical industries like pharmaceutical (R&D, QA & QC), polymers, , environmental and pollution control, nanotechnology and composite materials, teaching and research, etc.

PSO7: Have the personal attributes and ethical sensibilities to enable them to function as effective scientists and citizens

REGULATIONS

1. The duration of the course is for two academic years with total four semesters. The nature of the course is full-time.
2. Candidates for the degree of Master of Science in Chemistry shall be required to have passed the B.Sc with Chemistry / Applied Chemistry / Industrial Chemistry as one the subject of this university or any other university recognized by the academic council as equivalent thereto.
3. The course and scope of instruction shall be as defined in the syllabus prescribed. (Annexure-III)
4. Candidate who takes instruction shall be required to take examinations at the end of each semester as specified in Annexure-I.
5. Each candidate has to undergo an internship for a duration of four weeks during the fourth semester in any chemical industry/ R&D / organization/ or at the department at their own expense and have to submit project report.
6. A candidate shall be declared to have passed in any course if he /she secures not less than "E" grade in theory and not less than "D" grade in the practical /Project, provided the result otherwise is withheld. There is no minimum pass marks for internal assessment marks both theory as well as practical.

A candidate shall be deemed to have satisfied the minimum requirement for the award of the degree of M.Sc. Chemistry.

i. If he / she is declared to have passed all the subjects included in the scheme of instruction and examination and
ii. if he /she secures 5.0 CGPA in each of the semesters by the end of the fourth semester.

Further, a candidate shall be permitted to choose any course(s) to appear for improvement in case the candidate fails to secure the minimum prescribed SGPA/CGPA to enable the candidate to pass at the end of any semester examinations. There shall not be any provision for the improvement of internal assessment marks in any theory or practical subjects in any year /semester of study. Grades and calculation of SGPA and CGPA are given in Annexure-II

7. The successful candidates in the M.Sc Chemistry degree examination shall be arranged in the order in which they are registered for the examination in the following classes on the basis of the CGPA. However, students who pass in any supplementary examination shall not be awarded Distinction even if they obtain a CGPA of 8.0 or above, they shall be considered as First Class only.

First Class with Distinction	– CGPA 8.0 or more
First Class	– CGPA 7.0 or more but less than 8.0

Second Class/Pass – CGPA 5.0 or more but less than 7.0

8. The Question course setting and valuation shall be as per the University regulations at the end of each semester.
9. The practical examinations shall be conducted and valued by both internal and external examiners at the end of each semester.
10. The viva- voce examination for Project Work shall be conducted both internal and external examiners at the end of the completion of project and after submission of the Project Report by each of the candidates.

11. The Minimum attendance required by a candidate will be 75% of the total number for the working days in that semester. Provided that in special cases and for sufficient cause shown, the Vice-chancellor may, on the recommendation of the Principal and the Head of the department concerned, condone the deficiency in the average attendance to an extent of 9% for reasons such as ill health, if the application for condonation is submitted at the time of actual illness and is supported a certificate of an authorized medical officer approved by the Principal. However, 100% attendance should be maintained for all practicals/ labs/ Internship>
12. Each of the student has to study two MOOC courses from NPTEL/SWAYAM etc. one in the third semester and the other in the fourth semester of the programme and the grade obtained should be submitted to the Department/ College/ University for incorporation in the marks list along with the Grade/ Course Completion Certificate. The Departmental Committee shall decide whether to accept or not the grade/score obtained by the student. The student has to complete each of these courses during the concerned semester period only.
13. Keeping in view of the objectives of NPE 2020 and the directives of the University, two value added courses have been included each in 3rd and 4th semesters of the course. Intellectual Property rights in 3rd semester and Research Methodology in the 4th semester under non-credit scheme. However, the students have to attend the examination and pass the examination similar to that of other subjects of the course.
14. The University may, from time to time, revise, amend or change the regulations, scheme of examination and syllabus. In the case of students already undergoing the course, the changes will take effect from the beginning of the following academic year after the change are introduced and shall cover the part of the course that remains to be completed.

M.SC. CHEMISTRY WITH SPECIALIZATION ORGANIC CHEMISTRY
SCHEME OF INSTRUCTION AND EXAMINATION FOR I-SEMESTER

Course code	Course Title	Course type (Theory/ Practical)	Instruction periods per week	Internal Marks	External Marks	Total Marks	Duration of Examination	Credits
SCS -117	General Chemistry-I	Theory	04	20	80	100	3 hrs	04
SCS -118	Inorganic Chemistry-I	Theory	04	20	80	100	3 hrs	04
SCS -119	Organic Chemistry-I	Theory	04	20	80	100	3 hrs	04
SCS -120	Physical Chemistry-I	Theory	04	20	80	100	3 hrs	04
(PR-347)	Inorganic Chemistry Laboratory-1	Practical	06	15	60	75	3 hrs	03
(PR-348)	Physical Chemistry Laboratory-1	Practical	06	15	60	75	3 hrs	03
(PR-349)	Organic Chemistry Laboratory-1	Practical	06	15	60	75	3 hrs	03
		Total	34			625		25

M.SC. CHEMISTRY WITH SPECIALIZATION ORGANIC CHEMISTRY
SCHEME OF INSTRUCTION AND EXAMINATION FOR II-SEMESTER

Course code	Course Title	Course type (Theory/ Practical)	Instruction periods per week	Internal Marks	External Marks	Total Marks	Duration of Examination	Credits
SCS -215	General Chemistry-II	Theory	04	20	80	100	3 hrs	04
SCS -216	Inorganic Chemistry-II	Theory	04	20	80	100	3 hrs	04
SCS -217	Organic Chemistry-II	Theory	04	20	80	100	3 hrs	04
SCS -218	Physical Chemistry-II	Theory	04	20	80	100	3 hrs	04
(PR-350)	Inorganic Chemistry Laboratory-1I	Practical	06	15	60	75	3 hrs	03
(PR-351)	Physical Chemistry Laboratory-I1	Practical	06	15	60	75	3 hrs	03
(PR-352)	Organic Chemistry Laboratory-1I	Practical	06	15	60	75	3 hrs	03
		Total	34			625		25

M.SC. CHEMISTRY WITH SPECIALIZATION ORGANIC CHEMISTRY
SCHEME OF INSTRUCTION AND EXAMINATION FOR III-SEMESTER

Course code	Course Title	Course Type	Instruction Periods per week	External Marks	Internal Marks	Total Marks	Duration of External Examination	Credits
SCOS-310	Paper-I: Organic Reaction Mechanisms, Pericyclic Reactions and Photochemistry	Theory	4	80	20	100	3 hours	4
SCOS-311	Paper-II: Organic Spectroscopy	Theory	4	80	20	100	3 hours	4
SCOS-312	Paper-III: Organic Synthesis	Theory	4	80	20	100	3 hours	4
SCOS-313	Paper-IV: Chemistry of Natural Products	Theory	4	80	20	100	3 hours	4
(PR-819)	Practical - I: Multi Stage Organic Synthesis	Lab	3	80	20	100	6 hours	4
(PR-A 1060)	Practical - II: Chromatography & Viva-Voce	Lab	3	80	20	100	6 hours	4
	MOOCs Course	-				-	-	2
		Total:				600		26

M.SC. CHEMISTRY WITH SPECIALIZATION ORGANIC CHEMISTRY
SCHEME OF INSTRUCTION AND EXAMINATION FOR IV-SEMESTER

Course code	Course Title	Course Type	Instruction Periods per week	External Marks	Internal Marks	Total Marks	Duration of External Examination	Credits
SCOS -411	Paper-I: Modern Synthetic Methodology in Organic Chemistry	Theory	4	80	20	100	3 hours	4
SCOS -412	Paper-II: Organic Spectroscopy and Structure determination of Natural Products	Theory	4	80	20	100	3 hours	4
SCOS- 413	Paper-III: Designing Organic Synthesis and Synthetic Applications of Organo-Boranes and silanes	Theory	4	80	20	100	3 hours	4
SCOS- 414	Paper-IV: Drug Design and Drug Chemistry	Theory	4	80	20	100	3 hours	4
	Project Work	Lab	-	100	-	100	-	4
(PR-820)	Practical - I: Organic Mixture Analysis	Lab	3	80	20	100	6 hours	4
(PR-A 1050)	Practical - II: Estimations and Isolation	Lab	3	80	20	100	6 hours	4
(VV-673)	Viva-Voce	-	-	-		50	-	2
	MOOCs Course	-				-	-	2
		Total:				750		32

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SEMESTER-I
PAPER-I: GENERAL CHEMISTRY-I

Course Outcomes (COs)/Course Specific Outcomes (CSOs):

Upon completion of the course the students will be able to,

CO1: Learn and understand the selection rules and criteria for molecules to exhibit rotational and IRspectroscopy.

CO2: Understand the Classical and quantum mechanical theories of Raman spectroscopy and basic concepts of electronic spectroscopy.

CO3: Learn spectroscopic methods based on magnetic resonance principles.

CO4: Learn basics of group theory and its application in chemistry.

CO5: Understand the basic concepts of FORTRAN programming and its applications.

Learning Outcomes (LOs):

Upon completion of the course the student will be able

- To apply the spectroscopic methods for structure elucidation of molecules.
- To acquire knowledge of molecular symmetry and group theory and to solve chemical problems.
- To write FORTRAN programs for simple chemical problems.

COURSE CONTENT

UNIT – I

Rotational spectra of diatomic molecules-rigid rotor-selection rules-calculation of bond length-isotopic effect, second order stark effect and its applications, Infrared spectra of diatomic molecules-harmonic and anharmonic oscillators. Selection rules-overtones-combination bands calculation of force constant, anharmonicity constant and zero point energy. Fermi resonance, simultaneous vibration rotation spectra of diatomic molecules.

UNIT-II

Raman effect-classical and quantum mechanical explanations-Rotational Raman and vibrational Raman spectra, Electronic spectra of diatomic molecules-Vibrational coarse structure-intensity of spectral lines-Franck Condon principle-applications, Rotational fine structure-band head and band shading, Charge transfer spectra.

UNIT-III

Spin Resonance Spectroscopy: Principle and theory of NMR spectroscopy-Nature of spinning particle and its interaction with magnetic field. Chemical shift and its origin. Spin-Spin interaction-experimental methods. Application of NMR to structural elucidation-Structure of ethanol, dimethylformamide, styrene and acetophenone. Principle and theory of ESR-g-factor, hyperfine interactions-applications of ESR studies to the structure of free radicals, metal complexes.

UNIT-IV

Basic concepts of Symmetry and Group theory – Symmetry elements, symmetry operations and point groups – Schoenflies symbols – Classification of molecules into point groups – Axioms of Group theory – Group multiplication tables for C_{2V} and C_{3V} point groups – Similarity Transformation and classes – Representations – reducible and irreducible representations, Mulliken symbols, Orthogonality theorem and its implications, character table and its anatomy.

UNIT-V

Basic components of Computers, higher and lower level languages, Microsoft Fortran: constants, variables and operators, arithmetic expressions, assignment and replacement statements, Input and Output statements – Format free and Format directed I/O statements – Iw, Fw.d, Ew.d and Gw.d format specifications, conditional and unconditional statements – Logical IF, Block IF and Go To statements, Do statement – syntax and rules.

Application of Chemical Problems:

Flowcharts and Programs for

1. Statistical Analysis calculation of arithmetic mean, mean deviation, variance and standard deviation of replicate measurements.
2. Solution of Quadratic equation – calculation of the roots of a quadratic equation.
3. Calculation of the pH and hydrogen ion concentration of an aqueous solution of a strong acid taking into account the auto ionization of water.
4. Calculation of the root of a polynomial using Gauss-Newton method – Application to Vander-Waal's equation.
5. Calculation of the rate constant of a first order reaction or calculation of molar extinction coefficient using Beer-Lambert's Law by Linear least-squares method.

Text Books:

1. Symmetry and Spectroscopy of Molecules, K Veera Reddy, New Age International Publishers.
2. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
3. Chemical Applications of Group Theory, F. A. Cotton Wiley Eastern Limited New Delhi.
4. Group Theory and its Applications to Chemistry, K. V. Raman, Tata McGraw – Hill Publishing Company Ltd., New Delhi.
5. Computer programming in Fortran-IV by V .Rajaraman, Prentice-Hall of India Pvt. Ltd., New Delhi.
6. Molecular Spectroscopy, - Gordon M. barrow
7. Fundamentals of Molecular Spectroscopy – Banwell.

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SEMESTER-I
PAPER-II: INORGANIC CHEMISTRY-I

Course Objectives: To make the students

CO1: Acquiretheknowledgeon applications of VSEPR, Valence Bond and Molecular orbital theories in explaining thestructures of simple molecules **and** role of p and d orbitals in pi bonding.

CO2: Understandthe concept of MO theory to square planar ($PtCl_4^{2-}$) and Octahedral complexes (CoF_6^{3-}, $Co(NH_3)_6^{3+}$).And Walsh diagram for H_2O molecule

CO3: Apply theknowledgeandunderstandingofUnderstand the Orgel and Tanabe-Sugano diagrams for d^1 –d^9 octahedral and tetrahedral transition metal complexes of 3d series tonewly prepared metal complexes

CO4: Develop interest in the areas of magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes.

CO5: To understand the concept of Term symbols and Electronic spectra and Magnetic properties of complexes

LearningOutcomes: Attheendofthecourse,thelearnersshouldbeableto:

LO1: Explainidea of structure and bonding theories of inorganic compounds

LO2: InterpretWalsh diagram for other liner and bent molecules

LO3: Introduce electron counting rules for higher boranes

LO4: Analyse the preparation and structures of heteropoly acids

LO5: Understanding structure and bonding in coordination compounds

LO6: Explain selections rules, Tanabe-Sugano diagrams. Orgel diagrams

LO7: Experimentally Identify the covalency in metal complexes.

LO8: To calculate the magnetic susceptibility of metal complexes

LO9: Understand and analyse structure-property correlation of coordination compounds

LO10: Design new coordination compounds based on a fundamental understanding of their electronic properties

COURSE CONTENT

UNIT-1

Structure & Bonding: Applications of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules- role of p and d orbitals in pπ-dπ bonding, Bent's rule, Non-valence cohesive forces

Application of MO theory to square planar ($PtCl_4^{2-}$) and Octahedral complexes (CoF_6^{3-}, $Co(NH_3)_6^{3+}$). Walsh diagrams for linear (BeH_2) and bent (H_2O) molecules

UNIT-II

Inorganic cage and ring compounds – preparation, structure and reactions of boranes, carboranes, metallocarboranes, boron–nitrogen ($H_3B_3N_3H_3$), phosphorus–nitrogen ($N_3P_3Cl_6$) and sulphur-nitrogen (S_4N_4, $(SN)_x$) cyclic compounds. Structure and bonding in higher boranes with (special reference to B12 icosahedra). Electron counting rules in boranes – Wades rules (Polyhedral skeletal electron pair theory).

Polyacids: Introduction to polyacids- Types of polyacids- Isopolyacdis, Isopoly molybdates, Isopolytungstates, Isopolyvanadates, Structures of Polyacids $]Mo_7O_{24}]$,$^{6-}$$(V_{10}O_{28})^{6-}$ and $W4O_{16}]^{8-}$, Heteropolyacids- properties of heteropolyacids and salts, structures of heteropolyacids and theories , Mialalicopause and Roscnneium theories , Pauling's theory and keggin's theory, applications of polyacids.

UNIT-III

Coordination compounds: Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies – Spectrochemical series, Jahn – Teller theorem (static and dynamic Jahn-Teller theorem) and its consequences, nephelauxetic effect, applications and limitations of CFT; ligand field theory

Experimental evidences for covalence in complexes. Molecular Orbital Theory of bonding for Octahedral, tetrahedral and square planar complexes. π-bonding and MOT - Effect of π - donor and π -acceptor ligands on Δo. Experimental evidence for π - bonding in complexes

UNIT- IV

Electronic spectra of transition metal complexes:

Term symbol-Free Ion terms and Energy Levels: Configurations, Terms, States and Microstates, calculation of Microstates for P^2 and d^2 Configuration, Russell- Saunders Coupling Schemes, J-J Coupling scheme, derivation of terms for various configurations P^2 and d^2 configuration, spectroscopic Ground state , Hole Formalism, Energy ordering of terms (Hund's Rules), Selection rules: Laporte orbital selection rule, spin selection rules. Splitting of energy levels and spectroscopic states Orgel diagrams of d^1 to d^9 metal complexes. Interpretation of electronic spectra of aquo Complexes of Ti(III), V(III), Cr(III), Mn(II), Fe(II), Fe(III), Co(II), Ni(II) and Cu(II). Calculation of interelectronic and spectral parameters for d^8 metal complexes.

UNIT- V

Tanabe- Sugano diagrams for d^1 –d^9 octahedral and tetrahedral transition metal complexes of 3d series. Calculation of Dq, Racah Parameter (B) and nephelauxetic parameter (β), Charge transfer (L→M and M→L) spectra of metal complexes.

Magnetic properties of metal Complexes: Types of magnetic behavior, Temperature independent paramagnetism. Magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes. Magnetic susceptibility and its determination by Gouy's method, and Faraday's method. orbital contribution to magnetic moment ($O_h$and T_d Complexes)

Text books:

1. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson, IV Edition, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III Edition, Harper International Edition, 1983.
3. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999)

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SEMESTER-I
PAPER-III: ORGANICCHEMISTRY-I

Course Objectives: To make the students

CO1: Acquiretheknowledgeofaliphaticnucleophilic,aliphaticelectrophilic,stereochemistryand conformational analysis, chemistry of heterocyclic compoundsandchemistryofnaturalproducts

CO2: Understandaliphaticnucleophilic, aliphaticelectrophilic, stereochemistry andconformational analysis, chemistry of heterocycliccompounds and chemistry ofnaturalproducts

CO3: Apply theknowledgeandunderstandingofaliphaticnucleophilic,aliphaticelectrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products to new situations

CO4: Develop interest in the areas of aliphatic nucleophilic, aliphatic electrophilic,stereochemistry and conformational analysis, chemistry of heterocyclic compoundsandchemistryofnaturalproducts

LearningOutcomes: Attheendofthecourse,thelearnersshouldbeableto:

LO1: Explainaliphaticnucleophilic,aliphatic electrophilic,stereochemistryandconformational analysis, chemistry of heterocycliccompounds and chemistry ofnaturalproducts

LO2: Interpretaliphaticnucleophilic,aliphatic electrophilic,stereochemistryandconformational analysis, chemistry of heterocycliccompounds and chemistry ofnaturalproducts

LO3: Comparealiphaticnucleophilic, aliphaticelectrophilic,stereochemistryandconformational analysis, chemistry of heterocycliccompounds and chemistry ofnaturalproducts

LO4: Analysealiphaticnucleophilic,aliphaticelectrophilic,stereochemistryandconformationalanalysis, chemistry of heterocycliccompounds and chemistry ofnaturalproducts

LO5: Solvealiphaticnucleophillic,aliphaticelectrophilic,stereochemistryandconformational analysis, chemistry of heterocycliccompounds and chemistry ofnaturalproducts

LO6: Identify aliphatic nucleophilic,aliphaticelectrophilic, stereochemistry andconformationalanalysis,chemistryofheterocycliccompoundsand chemistryofnaturalproducts

LO7: Apply aliphaticnucleophilic,aliphaticelectrophilic, stereochemistry andconformationalanalysis,chemistryofheterocycliccompoundsand chemistryofnaturalproducts

COURSE CONTENT

UNIT–I

Aliphatic Nucleophilic Substitutions: The SN2, SN1, SNi and SET mechanisms.Substitutionreactionsofambidentnucleophiles,anchimericassistance,theneighbouring group mechanism: neighbouring group participation by 0,N, S,halogens, aryl groups, alkyl and cycloalkyl groups in nucleophilic substitutionreactions. Sigma, Pi bond participation in acylic and bicyclic systems (Non-classiccarbocations).NucleophilicSubstitutional allylic,ŁrigonalandVinyliccarbons.Effectofsubstrate,attackingnucleophile,leavinggroupandreactionmedium

UNIT-II

Aliphatic Electrophilic Substitutions: SEI SE2 and SEi mechanisms. Reactivity-effects of substrate, leaving group and solvent. Reactions- hydrogen exchange,migration of doublebonds, halogenation of aldehydes, ketones, carboxylic acids, acylhalides,sulphoxidesandsulphones.

UNIT-III

Stereochemistry and Conformational Analysis: Optical Isomerism:FiCal activity,moleculardissymmetryand chirality- elements of symmetry.Fisher'sprojectionD,L. and R,S. configurations - relative and absolute configurations optical isomerismdue to asymmetric carbon atoms - optical isomerism in biphenyls, allenes andspirans-opticalisomerismofnitrogenouscompounds,racemisationandresolution.

Geometricalisomerism:E,Z-configurations,propertiesofgeometricalisomers.Conformationalanalysis:Conformationsofacyclicmolecules-alkanesandsubstitutedalkanes-compoundshavingintramolecularhydrogenbonding.Conformations of cyclohexane, mono and disubstituted cyclohexanes and decalins,effectofconformationsonreactivity.

UNIT—IV

Chemistry of Heterocyclic Compounds :Structure, reactivity and synthesis of threemembered Heterocycles: (a) Oxirane: Sharpless method, Shi epoxidation, Jacobsenepoxidation, etc, (b) Aziridine; four membered Heterocycles: (a) Oxetane (b) Azetine;five memberedHeterocycles:(a) Pyrrole: Paa1 Knorr, Hantzsch Methods,etc, (b)Thiophene: Paa1 Knorr, Hinsberg method, etc. (c) Furan: Paa1 Knorr, Fiest-Benary,IndustrialMethod, etc.; (d) Pyrazole,(e) Imidazole,(f) Oxazole, (g) Thiazole; Sixmembered Heterocycles: (a) Pyridine, (b)Pyridazine,(c) pyrimidine and (d) Pyrazine;Aromatic heterocyclics: a) Indole: Fischer indole synthesis, Bischler synthesis, andMadelungsynthesis(b)QuinolineandIsoquinoline,(c)CoumarinsandChromones.

UNIT—V

Chemistry of Natural Products:

Terpenoids:-Occurrence,Isolation,isoprenerule,structureelucidationandsynthesisofn-Terpineolandn-pinene

Steroids:-Nomenclatureofsteroids,structureelucidation,synthesisandstereochemistryofcholesterolandprogesterone

Lipids:-Classification,propertiesandfunction-freefattyacids,triglycerides,phospholipids,glycolipids&waxesconjugatedlipids-lipoproteins

.**ReferenceBooks**

1. AdvancedOrganicChemistry:ReactionsMechanismsandStructurebyJerryMarch, Mc.GrawHillandKogakush.
2. OrganicChemistryVol.I(Sixth Ed.)andVol.II(FifthEd.)byILFinarELBS.
3. OrganicChemistry(fifthEd.,)byMorrison andBoyd,PHI,India.
4. OrganicChemistry(fifthedition)byFrancisA.CareyTataMcGrawHillpublishing

CompanyLimited,NewDelhi.

5. StereochemistryofOrganiccompoundsbyErnestL.E1ie1,SamuelH.Wilen

6. Chemistry of natural products by S. V. Bhat, B. A. Nagasampangi and M.Sivakumar NarosaPublishingHouse,6threprint2010

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SEMESTER-I
PAPER-IV: PHYSICALCHEMISTRY-I

Course Outcomes (COs)/Course Specific Outcomes (CSOs)
Upon completion of the course the students will be able to,

CO1: Explain the basic concepts of Thermodynamics and its applications

CO2: Understand the concepts of thermodynamics of solutions.

CO3: To understand the principle of micellisation.

CO4: Understand the various kinetic theories, measurements of reaction rates.

CO5: Learn experimental techniques for measuring the kinetics of fast reactions and homogenous catalyzed reactions.

Learning Outcomes (LOs):
Upon completion of the course the student will be able to understand

LO1: To apply the concepts of thermodynamics to various problems in chemistry.

LO2: To predict various reaction mechanisms.

LO3: To apply the concept of micellization to various chemical reactions.

COURSE CONTENT

UNIT-I

Basic concepts of second law of Thermodynamics-Entropy- Entropy changes accompanying different processes-Entropy changes in an ideal gas, entropy changes in the mixing of ideal gases, entropy as a function of V and T and entropy as a function of P and T- Entropy change in isolated systems- Clausius inequality-Helmholtz and Gibbs energy -Maxwell relations - Criteria for spontaneity-variation of Gibbs energy with temperature and pressure for solids, liquids and gases-Concept of fugacity-determination of fugacity coefficient of gases-Thermodynamics of phase transitions- Concept of chemical potential-Location of phase boundaries- (Clausius-Clapeyron equation for Liquid- Vapour, Solid -Liquid and Solid-Vapour boundaries)- Ehrenfest classification of phases.

UNIT-II

Thermodynamics of mixtures -partial molar quantities - experimental methods of determination of partial molar quantities -Gibbs-Duhem equation and Duhem-Margules equation-Thermodynamics of mixing of liquids (ΔH_{mix}, ΔG_{mix} and ΔS_{mix}) - Thermodynamics of ideal solutions - Raoult's law -Thermodynamics of colligative properties of dilute solutions - concept of activity and activity coefficient- Experimentaldetermination of activity coefficient - Thermodynamic concept of equilibrium, variation of equilibrium with temperature (Van't Hoff equation) and pressure - Nernst heat theorem, Third law of thermodynamics- exceptions to third law of thermodynamics.

UNIT-III

Surface tension- Capillary action- Adsorption-Adsorption isotherms- Freundlich adsorption isotherm, Langmuir adsorption isotherm-limitations - BET adsorption isotherm-estimation of Surface area.Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization- phase separation and mass action models.

UNIT-IV

Chemical Kinetics: Theories of reaction rates- Collision theory- Limitations, Transition state theory.Lindeman's theory of unimolecular reactions -Limitations. Diffusion controlled reactions. Effect of ionic strength on rates of reactions- Primary and secondary salt effects. Effect of dielectric constant onreactions - kinetic isotope effect -Primary and secondary isotopic effects -Effect of substituent -Linear free energy relationships - Hamett equation - limitations- Taft equation. Kinetics of consecutive reactions, parallel reactions, opposing reactions (Uni molecular steps only, no derivation).

UNIT-V

Specific and general acid-base catalysis. Skrabal diagrams. Steady state approximation- Enzyme catalysis- Michaelis -Menten mechanism. Derivation of Kinetic equation and Kinetic parameters. Lock and Key hypothesis-pH dependence of enzyme catalyzed reactions.Fast reactions- different methods of studying fast reactions- flow methods, relaxation methods- temperature jump and pressure jump methods.

Text Books:

1. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
2. Chemical Kinetics by K. J. Laidler, McGraw Hill Pub.
3. Physical chemistry by K.L. Kapoor

Reference Books:

1. Thermodynamics for Chemists, Samuel Glasstone
2. Physical chemistry by Puri, Sharma and Pathania
3. Micelles, Theoretical and applied aspects, V. Moroi, Plenum publisher

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SEMESTER-I
PRACTICAL I: INORGANICCHEMISTRY

Course Objectives:

CO1: To develop an insight into the preparation of inorganic complexes
CO2: To understand the process of preparation of inorganic complexes
CO3: To acquire skills in the preparation of inorganic complexes

Learning Outcomes:

At the end of the course, the learners should be able to:

LO1: Prepare various inorganic complexes
LO2: Develop skill in handling apparatus, measure the quantities and carryout the reaction and analyse the inorganic mixtures
LO3: Applies the skill in preparing new metal complexes and analysis of inorganic mixtures
LO4: Understand the regulations in handling and disposal of chemicals.

COURSE CONTENT

1. **Synthesis of Inorganic Metal Complexes:**Synthesis of 3d transition metal complexes of tetrahedral, square planar and octahedral geometries.
   (i) Preparation of TetraammineCopper(II) sulphate monohydrate
   (ii) Potassium tris-oxalatoferrate (III) trihydrate
   (iii) Tris-thiourea copper(I) sulphate

2. **Systematic SemimicroQualitative Analysisof Inorganicsix radical mixtures**
   In systematic Semi micro qualitative inorganic analysis, inorganic mixture containsthree cations and three anions. The analysis involves identification and conformation of cations and anions containing one less familiar cation(Tungsten, Molybdenum, Zirconium, Thorium, Titanium, Uranium, Cerium, Vanadium, Lithium, Berkelium Etc... and one interfering anion

Anions: CO_3^{2-} , S^{2-} , SO_3^{2-} , Cl^- , Br^- , I^- , NO_3^- , SO_4^{2-}, CH_3COO^-, $C_2O_4^{2-}$, $C_4H_4O_6^{2-}$, PO_4^{3-} , CrO_4^{2-}, AsO_4^{3-}, F^-, BO_3^{3-}

Cations : Ammonium (NH_4^+),1st group: Hg, Ag, Pb, Tl, W ; 2nd group: Hg, Pb, Bi, Cu, Cd, As, Sb, Sn, Mo; 3rd group: Fe, Al, Cr, Ce, Th, Ti, Zr, V, U, Be
4th group: Zn, Mn, Co, Ni5th group: Ca, Ba, Sr6th group: Mg,K, Li

Note: A minimum of 4 inorganic mixtures must be analysed in this Semester

REFERENCE BOOKS:

1. Practical Inorganic Chemistry, G. Marr and B. W. Rockett.

2. Practical Inorganic Chemistry by G.Pass H.Sutchiffe,2nd edn John Wiley & Sons.

3. Experimental Inorganic/Physical Chemistry, M. A. Malati, Horwood Publishing, Chichester, UK (1999)

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SEMESTER-I
PRACTICAL II: PHYSICALCHEMISTRY

Course Objectives:

CO1: To maintain laboratory ethics, safety and cleanliness
CO2: To Preparation and standardization of solutions
CO3: To have hands-on experience/practical knowledge in performing Physical chemistry experiments
CO4: To develop skills on handling instruments like conductometry and perform different types of acid-base titrations
CO5: To plot accurate graphs of the desired scale for the calculations of Langmuir and Freundlich isotherms
CO6: To Prepare the solution of the desired concentration and the desired volume in Cuprammonium cation.

LearningOutcomes:

At the end of the course, the learners should be able to:

LO1: To be able to develop/practical skills to solve problems in chemistry.
LO2: To extend the principle of Conductometric titration to other kind of reactions.
LO3: To learn to use the concept of phase diagram for different systems
LO4: To apply adsorption isotherms for other reactions.

COURSE CONTENT:

1. Conductometry
   a) Conductometric titration of strong acid (HCl) vs strong base (NaOH)
   b) Conductometric titration of weak acid (CH_3COOH) vs strong base (NaOH)
   c) Conductometric titration of mixture of acids (HCl + CH_3COOH) vs strong base (NaOH)
2. Determination of Cell constant of conductivity cell
3. Determination of Dissociation constant of weak acid by conductometric Method
4. Determination of Critical solution temperature of phenol-Water system
5. Determination of effect of electrolyte (NaCl) on the miscibility temperature of Phenol-Water system
6. Determination of composition of Cuprammonium cation using partition coefficient method
7. To verify Langmuir and Freundlich isotherm for absorption of acetic acid onto activated Charcoal

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SEMESTER-I
PRACTICAL III: ORGANICCHEMISTRY

Course Objectives:

CO1: To develop an insight into the preparation of organic compounds in various reactions

CO2: To understand the process of preparation of organic through various reactions

CO3: To acquire skills in the preparation of organic compounds, their separation, purification and identification

Learning Outcomes:

At the end of the course, the learners should be able to:

LO1: Prepare various organic compounds using various reactions

LO2: Develop skill in handling apparatus, measure the quantities and carryout the reaction, separate the products, purify them and analyse the products formed

LO3: Applies the skill in preparing novel organic moieties

COUSE CONTENT:

Synthesis of Organic compounds

Synthesis, purification and characterization of about ten organic compounds involving one or two stages.

List of some suggested compounds

1. β-Napthyl methyl ether from β-Naphthol
2. m-dinitrobenzene from Nitrobenzene
3. Azo dye from primary amine
4. Aromatic acid from ester
5. Benzanilide from aniline
6. p-nitroaniline from Acetanilide
7. p-Bromo acetanilide from aniline
8. Phthalimide from phthalic acid
9. 1,2,3-Tribromo benzene from aniline
10. Benzanilide from Benzophenone

Text Books:

1. A Textbook of Practical Organic Chemistry by A. I. Vogel, ELBS and Longman group.
2. Practical Organic Chemistry by Mann and Saunders, ELBS and Longman group.

MODEL QUESTION PAPER

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SEMESTER-I

Paper- I: GENERAL CHEMISTRY-I

Time: 3 hours **Max. Marks**: 80 **(5x16=80 Marks)**

Answer ALL questions

1. (a) (i) What kind of molecules exhibit microwave spectra.
   (ii) Discuss isotope effect in microwave spectra.

   (or)

   (b) (i) Derive an expression for energy or harmonic oscillator and discuss the selection rules.
   (ii) Describe the origin of PQR structure of Vibrational-Rotational spectra.

2. (a) (i) Discuss the classical and quantum mechanical theories of Raman spectra
   (ii) Explain rotational fine structure in electronic spectroscopy?

   (or)

   (b) (i) State and explain Franck Condon principle.
   (ii) Write a short note on charge transfer spectra.

3. (a) (i) Explain the terms spin active nuclei, resonance, Larmor precession and chemical shifts in NMR.
   (ii) Explain hyperfine interactions in ESR spectroscopy taking examples.

   (or)

   (b) (i) What are the factors affecting ‘g’ value in ESR spectroscopy.
   (ii) Explain spin-spin interactions in NMR spectroscopy?

4. (a) (i) State and explain the axioms of group theory.
   (ii) State the great Orthogonality theorem and discuss its implications

   (or)

   (b) (i) Give the points groups for NH_3, XeF_4, eclipsed C_2H_6, Cis C_2H_4, B_3,N_3H_6 and allene
   (ii) Describe the anatomy of character table.

5. (a) (i) Write a flowchart and FORTRAN program for calculation of rate constant of a first order reaction.
   (ii) Give the syntax and rules of DO statement

   (or)

   (b) (i) Write a flowchart and FORTRAN program for calculation of pH and hydrogen ion concentration of an aqueous solution of a strong acid taking into account the auto ionization of water
   (ii) Write a brief note on format direction Input/output statements.

MODEL QUESTION PAPER

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SEMESTER-I

Paper- II: INORGANIC CHEMISTRY-I

Time: 3 hours **Max. Marks**: 80 **(5x16=80 Marks)**

Answer ALL questions

1. (a) (i) Predict the geometries of ClF_3, XeF_4 and SF_4 molecules using VSEPR theory
   (ii) What is LCAO method? Predict bond order and bond lengths in O_2^+ and O_2^- ions based on MO energy level diagram

   (or)

   (b) (i) Draw the MO energy level diagram for $[Co(NH_3)_6]^{3+}$ and discuss its magnetic properties
   (ii) Draw the Walsh diagram for H_2O molecule and predict its structure.
2. (a) (i) Discuss the preparation of, structure of, and bonding in $N_3P_3Cl_6$.
   (ii) Discuss the structure and properties of borazole

   (or)

   (b) (i) Explain Mialalicopause and Rosenneium theories Pauling's theory and Keggin's theory of polyacids.
   (ii) Explain the method of counting skeletal electrons in cluster compounds

   (or)
3. (a) (i) Draw and explain the crystal field splitting of 'd' orbitals in square planar and trigonal bipyramidal geometries.
   (ii) Discuss the factors affecting crystal field splitting energies.

   (or)

   (b) (i) What are static and dynamic Jahn-Teller theorem and discuss its consequences
   (ii) Write a note on nephelauxetic effect
4. (a) (i) How do Tanable-Sugano diagrams differ from Orgel diagram? Draw Tanabe-Sugano diagram for $[V(H_2O)_6]^{3+}$
   (ii) Draw the Orgel diagram for $[TiCl_4]^-$ ion and explain the electronic transition

   (or)

   (b) (i) Write an account on Russell – Saunders coupling.
   (ii) Derive the terms symbols for Ni^{2+} and identify the ground state term symbol
5. (a) (i) Discuss different types of paramagnetic behaviour of transition metal complexes
   (ii) Calculate the spin only magnetic moments of the $[MnCl_6]^{3-}$ and $[Fe(CN)_6]^3$

   (or)

   (b) (i) Describe the Magnetic properties of inner transition metal complexes
   (ii) Determination of magnetic susceptibility a determination by Gouy's and Faraday's methods

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SEMESTER-I

Paper- III: ORGANIC CHEMISTRY-I

Time: 3 hours **Max. Marks**: 80 **(5x16=80 Marks)**

Answer ALL questions

1. (a) (i) Explain SN_2 reaction with stereo chemical evidence
   (ii) What are non-classical carbocations? Explain them.

   (or)

   (b) (i) Describe neighbouring group participation reactions of Oxygen and Halogens with an examples.
   (ii) Write a note on nucleophilic substitution reaction at allylic and trigonal carbons

2. (a) (i) Explain SE1 and SE2 reactions with examples.
   (ii) Write a note on halogenations of ketones and carboxylic acids with examples

   (or)

   (b) (i) Write a note on SE^i reaction and migration of double bonds
   (ii) Describe halogenations of sulphoxide and sulphones

3. (a) (i) Explain optical isomerism of biphenyls and spirans
   (ii) Write about racemization and resolution with examples

   (or)

   (b) (i) Describe the properties of geometrical isomers.
   (ii) Write the conformational analysis of cyclohexane with an example

4. (a) (i) Write any two synthesis and reactivity of Oxirane
   (ii) Explain any two synthesis and reactivity of Indole

   (or)

   (b) (i) Describe the synthesis and properties of Pyridine
   (ii) Write a note on coumarins and chromones with examples

5. (a) (i) Explain the synthesis of *a*-pinene
   (ii) Write any synthesis of progesterone

   (or)

   (b) (i) Explain triglycerides with examples
   (ii) Write the structure elucidation of cholesterol

MODEL QUESTION PAPER

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SEMESTER-I

Paper- IV: PHYSICAL CHEMISTRY-I

Time: 3 hours **Max. Marks**: 80 **(5x16=80 Marks)**

Answer ALL questions

1. (a) (i) Derive Maxwell's relations
   (ii) Define fugacity. How do you determine the fugacity of real gases?

   (or)

   (b) (i) Derive Clausius-Clapeyron equation
   (ii) Explain the entropy changes accompanying in different processes

2. (a) (i) Define partial molar quantity? Explain the experimental methods for determining partial molar quantities.
   (ii) Explain briefly about thermodynamics of mixing of liquids

   (or)

   (b) (i) State and explain third law of thermodynamics and write its limitations
   (ii) What is effect of temperature on equilibrium constant?

3. (a) (i) Discuss the features and limitations of Langmuir adsorption isotherm
   (ii) Give a classification of surface-active agents along with examples

   (or)

   (b) (i) What are important features of BET isotherm
   (ii) What is CMC? What are the factors affecting CMC

4. (a) (i) Discuss the Lindeman theory of unimolecular reaction and its limitations
   (ii) Write a note on diffusion-controlled reactions

   (or)

   (b) (i) Derive an expression for effect of ionic strength on rate of reaction
   (ii) Discuss the kinetics of consecutive reactions

5. (a) (i) Explain the Michaelis-Menten mechanism for enzyme catalysis
   (ii) Explain the mechanism of specific acid-base catalysis

   (or)

   (b) (i) Explain steady-state approximation with examples
   (ii) Explain temperature jump method for fast reactions and derive an expression for relaxation time

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SEMESTER-II
PAPER-I: GENERAL CHEMISTRY-II

Course Objectives:

CO1 Students will have the idea of wave function and understand the uncertainty relations

CO2 Students will learn how to solve the Schrodinger Eq. rigorously for model systems

CO3 Students will be able to understand and be able to explain the origin of quantized energy levels

CO4 Students will learn to apply concepts from physics and methods from mathematics to derive and understand the properties of chemical systems that arise from quantum mechanical models for the structure of atoms and molecules

CO5 They will be able to understand and explain the differences between classical and quantum mechanics

Learning Outcomes:

LO1 Gain knowledge about wave equation-interpretation of wave function-properties of wave function-normalization and orthogonalization.

LO2 Understand about symmetry arguments in deriving the selection rules, the concepts of tunneling-particle in three-dimensional box. Calculations using wave functions of the particle in a box.

LO3 Gain knowledge about Perturbation theory-time independent perturbation (only first order perturbation is to be dealt with) – application to ground state energy of helium atom

LO4 Study about variation principle-applications-calculation of zero-point energy of harmonic oscillator-many electron atom

LO5 Gain knowledge about Valence bond approach-directed valence-hybridization-covalent bond-calculation of ionic and covalent bond contributions in hydrogen molecule

LO6 Gain knowledge about hydrogen molecule ion-hydrogen molecule (fundamental concepts only

COURSE CONTENT

Unit I

Wave equation – interpretation of wave function – properties of wave function – normalization and orthogonalisation, operators – linear and non-linear commutators of operators, Postulates of quantum mechanics, setting up of operators observables – Hermitian operator – Eigen values of Hermitian operator.

Unit-II

Wave mechanics of simple systems with constant potential energy, particle in one dimensional box – factors influencing colour – transition – dipole integral, symmetry arguments in deriving the selection rules-the concept of tunneling – particle in a three dimensional box, Rigid rotor, wave mechanics of systems with variable potential energy-simple harmonic oscillator-solution of wave equation-selection rules.

UNIT-III

Hydrogen atom-solution of R(r), $\theta(\theta)$ and $\Phi(\phi)$ equations-probability density in orbitals-shapes of orbitals. Perturbation theory-time independent perturbation (only first order perturbation is to be dealt with) – application to ground state energy of hydrogen and helium atom

UNIT –IV

Variation principle-applications to hydrogen and helium atoms-calculation of zeropoint energy of harmonic oscillator-many electron atom- Comparison between Perturbation and variation theorems. Hartee-Fock self-consistent field method and introductory concepts of Density functional theory(DFT).

UNIT-V

Valence bond approach-directed valence-hybridization-covalent bond-calculation of ionic and covalent bond contributions in hydrogen molecule. Molecular orbital theory – LCAO approximation – hydrogen molecule ion – hydrogen molecule (fundamental concepts only) – The electronic transitions in the hydrogen molecule.

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SEMESTER-II
PAPER-II: INORGANICCHEMISTRY-II
(Effective from the admitted batch of 2021-2022)

Course Objectives:

CO1 To give a basic and updated knowledge for the students on metal clusters, Organometallic chemistry of transition metals

CO2 To discuss the preparation and structures of and functional aspects of metal clusters

CO3 Design new coordination compounds based on a fundamental understanding of their electronic properties

CO4 To discuss basics principles of reaction mechanism in metal complexes

CO5 To understand the concept of Term symbols and Electronic spectra and Magnetic properties of complexes

LearningOutcomes: Attheendofthecourse,thelearnersshouldbeable to:

LO1 Explain the idea of metal clusters

LO2 Interpret the bonding nature in metal clusters

LO3 Understand the basics of inorganic and coordination chemistry

LO4 Verity the 18 electron rules in various metal clusters

LO5 Determine the stability constants of metal complexes

LO6 Explain the kinetics of substitution reaction, conjugate bas mechanism and trans effect

LO7 Design new coordination compounds based on a fundamental understanding of their Reaction mechanism

COURSE CONTENT

UNIT-I

Metal cluster compounds - definition – evidences for existence of M-M bonds - conditions favorable for formation of M-M bonds – preparation, structure and bonding of the following metal cluster compounds.

$Re_2Cl_8^{2-}$, $Mo_2Cl_8^{4-}$, $Re_2(RCOO)_4X_2$, $Mo_2(RCOO)_4(H_2O)_2$, $Cr_2(RCOO)_4(H_2O)_2$, $Cu_2(RCOO)_4(H_2O)_2$, $Cr_2Cl_9^{3-}$, $Mo_2Cl_9^{3-}$, $W_2Cl_9^{3-}$, Re_3Cl_9, $Re_3Cl_{12}^{3-}$, $Mo_6Cl_8^{4+}$, $Nb_6X_{12}^{2+}$ and $Ta_6X_{12}^{2+}$.Polyatomic clusters – Zintle ions, Chevrel phases.

UNIT-II

Organometallic compounds - 16 and 18 electron rules.
Isoelectronicrelationship - Synthesis, structure, bonding and reactions of carbon monoxide, dinitrogen and nitric oxide complexes.
Isolobal relationship – H, Cl, CH_3, $Mn(CO)_5$; S, CH_2, $Fe(CO)_4$; P, CH, $Co(CO)_3$
Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene

UNIT-III

Metal Ligand equilibria in solution:
Step wise and overall formation constants and their interaction. Trends in stepwise constants ((statistical effect and statistical ratio), factors affecting the stability of metal complexes; Stability correlations - Irwing -William's series, Pearson's theory of hard and soft acids and bases (HSAB), Application of HSAB: Biological functions and toxicology of metals, and medicinal applications; chelate effect and its thermodynamic origin

UNIT-IV

Determination of stability constants of complexes by spectrophotometric method ((Job's method) and pH –metric method(Bjerrum's).
Reactivity of metal complexes – inert and labile complexes. Explanation of lability on the basis of valence bond and crystal field theories.

UNIT- V

Reaction Mechanisms of Metal Complexes:
Reactivity of metal complexes, inert and labile complexes, Kinetics and mechanisms of substitution reactions, kinetics of substitutions reactions in octahedral complexes, acid hydrolysis, Factors affecting acid hydrolysis, Base hydrolysis, Conjugate base mechanism, Anation reactions, substitution reactions in square planar complexes, Trans effect, Mechanism of trans effect, Electron transfer reactions-– concept of complementary and non-complementary reactions with examples, inner sphere and outer sphere mechanisms, Marcus theory.

Text books:

1. Advanced Inorganic Chemistry by F.A. Cotton and R.G. Wilkinson, IV Edition, John, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III edition, Harper International Edition, 1983.
3. Organometallic Chemistry-A unified approach by A. Singh and R.C. Mehrotra, Wiley Eastern Ltd.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999)
5. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
6. Mechanisims of Inorganic reactions in solution by D.Benson, MCgraw Hill, London, 1968.
7. Inorganic chemistry by K.F. Purcell and J.C.Kotz, W.B. Saunders company, New York, 1977.

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SEMESTER-II
PAPER-III: ORGANICCHEMISTRY-II

Course Objectives:

CO1 Acquire the knowledge of aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

CO2 Understand aromaticity, aromatic nucleophilic substitution, reactive intermediate and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

CO3 Apply the knowledge and understanding of aromaticity, aromatic nucleophilic substitution, reactive intermediate and name reactions, molecular rearrangements, spectroscopy, alkaloids peptides, proteins and nucleic acids to new situations

CO4 Develop interest in the areas of aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

Learning Outcomes: At the end of the course, the learners should be able to:

LO1 Explain aromaticity, aromatic nucleophilic substitution, reactivity intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO2 Interpret aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO3 Compare aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO4 Analyse aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO5 Solve aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO6 Identify aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids peptides, proteins and nucleic acids

LO7 Apply aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

COURSE CONTENT

UNIT-I: Aromaticity

A) **Aromaticity:** Concept of Aromaticity, Aromaticity of five membered, six membered and fused systems-non-benzenoidaromatic compounds:-cyclopropenylcation, cyclo butadienyldication, cyclopentadienyl anion — tropyliumcation and cyclo octatetraenyl dianion—matallocenes, ferrocenes, azulenes, fulvenes, annulenes, fullerenes. Homoaromaticity, Antiaromaticity and Pseudoaromaticity.

B) **Aromatic Nucleophilic Substitutions:** The SNAr, SN1, benzyne and SRN1 mechanisms. Reactivity: Effect of substrate, leaving group and attacking nucleophile. The Von-Richter, Somm1et-HauserandSmilesrearrangements.

UNIT-II: Reactive Intermediates and Name Reactions

A) **Reactive Intermediates:** Generation, structure, stability and reactivity of reactive intermediates: carbanion, carbocation, freeradicals, carbenes and nitrenes.

B) **NameReactions:**Wittigreaction,Grignardreaction,Storkenaminereaction,Michaeladdition, MannichReaction,Diel's-AlderreactionandEne-reaction

UNIT-III: Molecular Rearrangements

Molecular Rearrangements: Types of molecular rearrangements, migratory aptitude;

Rearrangements to electron deficient carbon: Pinacol-pinacolone, Wagner-Meerwein and Benzil-Benzilicacid,

Rearrangements toelectron deficientnitrogen: Beckmann, Hofmann, Curtius, Schmidt and Lossen rearrangements;

Rearrangements to electron deficient oxygen: Baeyer-villiger,Dakin rearrangements;

Other rearrangements: Neber rearrangement and Favorskii rearrangements

UNIT-IV: Spectroscopy

A) **UV Spectroscopy:** Various electronic transitions, selection rules, effect of solvent on electronic transitions, the absorption laws, chromophores, auxochromes, bathochromic and hypso chromic shifts, hyperchromic and hypochromic effects, Woodward-Fieser rules for conjugated dienes and carbonyl compounds.

B) **Infrared Spectroscopy:** Basic principles: types of molecular vibrations, fingerprint region and identification of functional groups.

C) **Nuclear Magnetic Resonance Spectroscopy (^{I}H-NMR):** nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shifts, factors affecting the chemical shift, and assignment of chemical shifts.

D) **Mass Spectroscopy:** Basic principles, nitrogen rule and fragmentation pattern of carbonyl compounds and alcohols

UNIT—V: Alkaloids, Peptides, Proteins and Nucleic acids

A) **ALKALOIDS:** Occurrence, Isolation, classification based on nitrogen heterocyclic ring and synthesis of quinine and nicotine

B) **Peptides and Proteins:** O-Amino acids, their general properties and synthesis, Synthesis of peptides by Merrifield solid phase synthesis. Primary, secondary and tertiary structures of proteins

C) **Nucleic acids**: Heterocyclic bases; Purines: Adenine and Guanine; Pyramidines: Cytosine, Uracil and Thymine; nucleosides, nucleotides Basic concepts of the structures of RNA and DNA

Textbooks:

1. Organic Chemistry Vol.I (SixthEdn.) and Vol.II (FifthEd.,) by ILfinarELBS.
2. Organic Chemistry (fifthEdn.,) by Morrison and Boyd, PHI, India.
3. Organic Chemistry (fifthedition) by FrancisA.Carey TataMcGraw Hillpublishing Company Limited, New Delhi.
4. ReactionMechanisminOrganicChemistrybyMukherjeeSirigh,NTerniit arr,Indiar
5. A guide book to mechanism in Organic Chemistry by Peter Sykes, ELBS.
6. Advanced organic chemistry by Jerry March (4thEdition)WileyEastern..
7. Stereochemistry of carbon compounds by E.Eliel, John Wiley &Sons, Inc.
8. Stereochemistry of Organic compounds by D.Nasipuri., Chemistry of Natural products by R.S. Kalsi Kalyani Publ

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SEMESTER-II
PAPER-IV: PHYSICAL CHEMISTRY -II

Course Outcomes (COs)/Course Specific Outcomes (CSOs)

Upon completion of the course the students will be able to,

CO1 Explain the basic concepts of Crystallography

CO2 Understand the types of polymers and analyze various physical properties of polymers

CO3 Understand the concepts of electrochemistry and theories like Debye Huckel theory

CO4 Understand the basic concept and theories of electrode-electrolyte interface

CO5 Learn principles of photochemistry and various photochemical reactions

Learning Outcomes (LOs):

Upon completion of the course the student will be able

- To determine electrical magnetic properties of solids.
- To apply the basic concept of electrochemistry to different electrochemical cells
- To predict the mechanisms of photochemical reactions

COURSE CONTENT

UNIT-I:

Crystal structure of solids: Fundamental of lattices, unit cell, Bravais lattices, symmetry elements in crystals, packing efficiency, radius ratios; Miller indices. structures and types of solids. Structure determination by X-ray diffraction (Bragg's equation). Magnetic properties of solids- classification of magnetic materials, Magnetic susceptibility, Measurement of magnetic susceptibility. Electric properties-Band theory, the band structure of metals, insulators, and semiconductors. The temperature dependence of the conductivity of extrinsic semiconductors. Superconductivity and occurrence. Meisner effect. Types of superconductors. Theories of superconductivity - BCS theory.

UNIT-II

Classification of polymers - Free radical, ionic and Zeigler - Natta Polymerization - kinetics of free radical polymerization - Techniques of polymerization - Glass transition temperature - Factors influencing the glass transition temperature - Number average and Weight average, Molecular weights - molecular weights determination - End group analysis - Osmometry - Light scattering and ultra-centrifugation methods.

UNIT-III:

Electrochemistry I: Ionic mobilities and conductivities - Debye-Huckel theory of strong electrolytes, Debye-Huckelonsagar equation-limitations- mean activity coefficient - Verification of Debye-Huckel limiting law. Electrochemical cell- Galvanic and electrolytic cell. Nernst equation-Concentration cell with and without transference- effect of complexation on redox potential- ferricyanide/ ferrocyanide couple, Iron(III) phenonthroline/ Iron(II) phenonthroline couple. Fuel Cells- construction-Various types-Examples.

UNIT-IV:

Electrochemistry II: The electrode-electrolyte interface. The electrical double layer. The Helmholtz-Perrin parallel-plate model, the Gouy-Chapman diffuse-charge model and the Stern model. Electrodics: Charge transfer reactions at the electrode-electrolyte interface.Derivation of Butler-Volmer equation. High field approximation, Tafel equation, Low field equilibrium, over voltage. Theories of over voltage- Corrosion - Concentration polarization - Polarography -Half wave potential and Ilkovic equation.

UNIT-V:

Photochemistry: Electronic transitions in molecules, Franck-Condon principle. Electronically excited molecules- singlet and triplet states, spin-orbit interaction. Quantum yield and its determination. Actinometry. Derivation of fluorescence and phosphorescence quantum yields. Quenching effect- Stern Volmer equation. Photochemical equilibrium and delayed fluorescence- E-type and P-type. Photochemical primary processes, types of photochemical reactions-photodissociation, addition and isomerization reactions with examples.

Text Books:

1. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.

2. Physical Chemistry by G.W. Castellon, Narosha Publishing House

3. Physical chemistry by K.L. Kapoor.

4. Principles of photochemistry, RohitgeeMukhargee.

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SEMESTER-II

PRACTICAL -I: INORGANIC CHEMISTRY

Course Objectives:

CO1 To have hands-on experience/practical knowledge in Inorganic chemistry experiments

CO2 To develop skills on estimations of analyte by volumetrically

CO3 To determine analyte by Gravimetrically

CO4 To study the photochemical reactions

Learning Outcomes:

At the end of the course, the learners should be able to:

LO1 To be able to solve problems in analytical chemistry

LO2 To extend the idea of determination of analyte by volumetric titration to advanced analytical determinations of various organic and inorganic analytes

LO3 Able to design gravimetric experiments for quantitative estimation of organic and inorganic analytes

COURSE CONTENT

Quantitative analysis:

1.Volumetric methods of Analysis:

i) Determination of Ferric iron by photochemical reduction

ii). Determination of Nickel by EDTA

iii) Determination of Calcium and Magnesium in a mixture by EDTA

iv) Determination of Ferrocyanide by Ceric sulphate

v) Determination of Copper(II) in presence of iron(III)

2.Gravimetric methods of Analysis:

i) Determination of Zinc as Zinc pyrophosphate

ii). Determination of Nickel from a mixture of Copper and Nickel.

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SEMESTER-II

PRACTICAL-II: PHYSICAL CHEMISTRY

Course Objectives:

CO1 To have hands-on experience/practical knowledge in performing Physical chemistry experiments

CO2 To develop skills on handling instruments like Potentiometry and perform different types of acid-base and redox titrations

CO3 To determine specific rotations and percentage of to optically active substances by polarimetrically

CO4 To study the stability of complex ion and stranded free energy change and equilibrium constant by potentiometry

Learning Outcomes:

At the end of the course, the learners should be able to:

LO1 To be able to develop/practical skills to solve problems in chemistry

LO2 To extend the principle of Potentiometric titration to other kind of reactions.

LO3 To study the kinetics of reactions and determine the order of reaction

COURSE CONTENT

1. Potentiometric titration of Iron (II) using potassium dichromate
2. Potentiometric titration of strong acid with a strong base using quinhydrone electrode
3. Determination of kinetics of Ester hydrolysis
4. Determination of Equilibrium constant of Potassium Iodide-Iodine system
5. Determination of kinetics of inversion of cane sugar by polarimetry method.
6. Determination of partial molar volume of solute –H_2O system by apparent molar volume method.

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SEMESTER-II

PRACTICAL III: ORGANIC CHEMISTRY

Course Objectives:

CO1 To develop an insight into the identification of organic compounds by systematic analysis

CO2 To understand the process of identification of organic compounds by systematic analysis

CO3 To acquire skills in the identification of organic compounds by systematic analysis

Learning Outcomes:

At the end of the course, the learners should be able to:

LO1 Identify an organic compound by systematic analysis

LO2 Develop skill in identification of organic compounds by systematic analysis

LO3 Apply the skill in the identification of new organic compounds by systematic analysis

COURSE CONTENT

Identification of the unknown organic compounds

Systematic identification of organic compounds – preliminary tests, detection of extra elements, solubility, common functional group tests (determination of functional group/s in a single compound, if present), preparation of two rational derivatives

The given organic compound must be identified by comparing the melting point /Boiling point of the compound and melting points of its derivatives with the literature

List of suggested compounds

Glucose, fructose, benzaldehyde, p-anisaldehyde, p-chloro benzaldehyde, acetophenone, phenol, cresols, naphthols, esters, p-chloro benzoic acid, aniline, p-tolune, p-anisidine, p-chloroaniline, diphenyl amine, N,N-dimethylaniline, benzamide, naphthalene and anthracene.

TEXT BOOKS

1. A Textbook of Practical Organic Chemistry by A. I. Vogel, ELBS and Longman group.
2. Practical Organic Chemistry by Mann and Saunders, ELBS and Longman group.

MODEL QUESTION PAPER

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SEMESTER-II

Paper I: General Chemistry-II

Time: 3 Hours **Maximum marks: 80 (5X16 =80 marks)**

Answer ALL questions

(1) (a) i) Derive Schrodinger wave equation?
ii) Explain the postulates of Quantum mechanics

(or)

(b) i) Write notes on Hermitian operator and its properties
ii) Explain normalization and orthogonalization

(2) (a) i) Solve the Schrodinger wave equation for a particle in a one-dimensional box
ii) Write the factors influencing color

(or)

(b) i) Derive the Schrodinger wave equation for a simple harmonic oscillator
ii) Describe the concept of tunnelling

(3) (a) i) Explain the solution of R(r), $\theta(\theta)$ and $\Phi(\phi)$ equations of hydrogen atom
ii) Explain probability density in orbitals

(or)

(b) i) Explain the time independent perturbation theory to evaluate the ground state energy of helium atom
ii) Application of above to ground state energy of hydrogen and helium atom

(4) (a) i) What is variation principle. Write its application to calculation of ground state energy of harmonic oscillator
ii) Compare Perturbation and variation theorems

(or)

(b) i) Explain Hartee-Fock self-consistent field method for multi electron atoms
ii) Write a note on Density functional theory (DFT)

(5) (a) i) Explain quantum mechanical approach of molecular orbital theory
ii) Calculate the ionic and covalent bond contributions in hydrogen molecule

(or)

(b) i) Discuss the valence bond approach of H_2 molecule.
ii) Write the electronic transitions in the hydrogen molecule.

MODEL QUESTION PAPER

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SEMESTER-II

Paper- II: Inorganic Chemistry-II

Time: 3 Hours **Max marks: 80 (5X16 =80M)**

Answer ALL questions

(1) a) (i) Discuss the structure and magnetic property of $Cu_2(RCOO)_4(H_2O)_2$
(ii) Write a note on Chevrel phases
(or)
b) (i) Discuss the preparation of, structures of and bonding in $Re_2Cl_8^{2-}$.
(ii) Describe the structures of hexanuclear metal clusters

(2) a) (i) Explain the synthesis, structure and reactions of metal carbonyls.
(ii) Explain Isolobal relationship with suitable examples.
(or)
b) (i) Describe the preparation of, structure of and bonding in ferrocene.
(ii) What is 18 electron rules? Illustrate with suitable examples

(3) a) (i) Explain the factors affecting the stability of coordination compounds
(ii) Distinguish between stepwise and overall stability constants
(or)
b) (i) Describe the Irwing-William's series, Pearson's theory of hard and soft acids and bases (HSAB)
(ii) What is chelate effect and discuss its thermodynamic origin

(4) a) (i) Discuss a spectrophotometric method for the determination of binary formation constant of a metal complex
(ii) What are inert and labile complexes?
(or)
b) (i) Describe the pH – metric method for the determination of stability constants
(ii) Explain inert and labile complexes by using crystal field stabilization energies?

(5) a) (i) What is acid hydrolysis reactions? Discuss factors affecting acid hydrolysis reactions
(ii) What is trans effect? Distinguish between the trans effect and trans influence
(or)
b) (i) Give an account of base hydrolysis of Cobalt (III) complexes
(ii) Discuss the various factors affecting the rates of substitution reaction of octahedral complexes

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SEMESTER-II

Paper- III: Organic Chemistry-II

Time: 3 Hours **Maximum marks: 80 (5X16 =80 marks)**

Answer ALL questions

(1) a) (i) Explain Aromaticity and Anti aromaticity give examples.
(ii) Write a note on Von- Ritcher rearrangement
(or)
b) (i) Describe Aromatic Nucleophilic Substitution reactions give examples.
(ii) Write a note on Non-benzenoid aromatic compounds and Annulenes.

(2) a) (i) Write any two preparations and reactivity of carbocation.
(ii) Write a note on Stork enamine reaction.
(or)
b) (i) Explain carbanion and nitrene
(ii) Briefly explain Mannich Reaction with applications.

(3) a) (i) Explain Pinacol-pinacolone rearrangement give examples.
(ii) Describe mechanism and applications of Beckmann rearrangement.
(or)
b) (i) Discuss about Baeyer-villager rearrangement.
(ii) Write a note on Favorskii rearrangement.

(4) a) (i) Write the Woodward-Fieser rules for conjugated dienes.
(ii) Explain types of molecular vibrations in Infrared Spectroscopy.
(or)
b) (i) Describe factors affecting the chemical shift.
(ii) Give the fragmentation pattern of alcohols.

(5) a) (i) Write the synthesis of nicotine
(ii) Explain Merrifield solid phase synthesis.
(or)
b) (i) Write about Primary, secondary and tertiary structures of proteins.
(ii) How do you differentiate RNA and DNA

MODEL QUESTION PAPER

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SEMESTER-II

Paper- IV: Physical Chemistry-II Semester-II

Time: 3 Hours **Max. Marks: 80 (5X16 =80M)**

Answer ALL questions

(1) a) (i) Derive Bragg's equation
(ii) Explain the theories of superconductivity

(or)

b) (i) Describe the different methods of measurement of magnetic susceptibility
(ii) Write a brief note on semiconductors

(2) a) (i) Give the classification of polymers with examples
(ii) What are the factors influencing glass transition temperature

(or)

b) (i) How is molecular weight of polymers determined by osmometry and light scattering methods
(ii) Write a brief note on kinetics of free radical polymerization

(3) a) (i) Explain Debye-Huckel theory of strong electrolytes
(ii) Discuss the effect of complexation on redox potential with examples?

(or)

b) (i) Derive an expression for EMF of concentration cell without transference
(ii) Discuss the important features of Debye-Huckel limiting law

(4) a) (i) Derive Bulter-Volmer equation
(ii) Explain the Stern model for double layer

(or)

b) (i) Explain in detail about polarography
(ii) Discuss important features of Gouy-Chapman diffuse charge model and Helmholtz parallel plate model

(or)

(5) a) (i) Derive Stern-Volmer equation
(ii) State and explain Franck-Condon principle

b) (i) Define quantum yield and explain its experimental method determination
(ii) Discuss the mechanism of photo addition and photo isomerization with examples

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SEMESTER-III

PAPER I - ORGANIC REACTION MECHANISMS, PERICYCLIC REACTIONSAND PHOTOCHEMISTRY

Course Objectives:

CO 1: Acquire the knowledge of reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

CO 2: Understand reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

CO 3: Apply the knowledge and understanding of new situations reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

CO 4: Develop interest in the areas of reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain reactions and mechanisms of Substitution, Elimination, Addition,Pericyclic and Organic Photochemistry

LO 2: Interpret reactions and mechanisms of Substitution, Elimination, Addition,Pericyclic and Organic Photochemistry

LO 3: Compare reactions and mechanisms of Substitution, Elimination, Addition,Pericyclic and Organic Photochemistry

LO 4: Analyse reactions and mechanisms of Substitution, Elimination, Addition,Pericyclic and Organic Photochemistry

LO 5: Solve reactions and mechanisms of Substitution, Elimination, Addition, Pericyclicand Organic Photochemistry

LO 6: Identify reactions and mechanisms of Substitution, Elimination, Addition,Pericyclic and Organic Photochemistry

LO 7: apply reactions and mechanisms of Substitution, Elimination, Addition, Pericyclicand Organic Photochemistry

COURSE CONTENT

UNIT-I: Radical Substitution Reactions

Reactivity for aliphatic substrates,reactivity at Bridgehead, Reactivity in aromatic substrates, neighbouring group assistance in free radical reactions, reactivity in the attacking radical, effect of solvent on reactivity, halogenation at an alkyl carbon and allylic carbon, hydroxylation at aromatic carbon by means of Fenton's reagent, formation of cyclic ethers with Pb (OAC)4, Hunsdiecker reaction, Kolbe reaction, Reed reaction and Sandmayer reaction.

NIT-II: Elimination Reactions

Mechanisms of E2, El, and E1CB, factors-effects of substrate,attacking base, leaving group and

medium. Stereochemistry of eliminations in acyclic and cyclic systems. Saytzeff elimination, Hoffman elimination and pyrolytic elimination.

UNIT-III: Addition Reactions

Addition to carbon-carbon multiple bonds- Addition reactions involving electrophiles, nucleophiles and free radicals, cyclic mechanisms. Stereochemistry and reactivity.Hydrogenation of double and triple bonds, Birch reduction, Hydroboration, Michael reaction,Prins reaction. Addition of oxygen and N_2O

Addition to carbon-hetero atom multiple bonds: Mechanism and reactivity.Reductions of carbonyl compounds, carboxylic acids, esters, nitriles. Addtion of Grignard reagents, Mannich reaction, Reformatsky reaction, Tollen's reaction, Wittig reaction,

UNIT-IV: Pericyclic reactions:

Molecular Orbital Symmetry, MO diagrams of ethylene, 1,3 Butadiene, 1,3,5- Hexatrieneand allyl system. Woodward- Hoffman correlation diagram method, Frontier molecular orbital approach (FMO) and Perturbation molecular orbital approach (PMO) for the explanation of pericyclic reactions under thermal and photochemical conditions. Classification of pericyclic reactions: **Electrocyclic Reactions**: Conrotatory and Dis rotatory motions. 4n π and 4n+2 π electrons systems. **Cycloadditions**: Antarafacial and Suprafacial additions. 2+2, 4+2 cycloadditions and chelotropic reactions.

Sigmatropic rearrangements

Suprafacial and Antarafacial shifts of H, Sigmatropic shift involving carbon moieties (1,3), (1,5), (3,3) and (5,5) sigmatropic rearrangements. Claisen, Cope, Oxy-cope and aza- Cope rearrangements. Ene reaction.

UNIT-V: Organic Photochemistry:

Photochemistry of carbonyl compounds- n-$\pi^*$and π-π^* transitions. Norrish type I and Norrish type II cleavages. Patterno-Buchi reactions, Photoreduction, Photo chemistry of α,ß- unsaturated ketones, photochemistry of enones and cyclohexadienones. Photochemistry of unsaturated systems (Olefins): cis-trans isomerisation, dimerization, and addition.Acetylenes- dimerisation. Photochemistry of 1,3 butadienes, di-π-methane rearrangement.Photochemistry of aromatic compounds – 1,2, 1,3, and 1,4- additions. Photo-Fries rearrangement, Photo- Fries reactions of anilides.

Text Books:

1. Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March,Mc.Graw Hill and Kogakush.
2. Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, PrenticeHall.
3. Pericyclic reactions by S.N. Mukharji, Mcmilan.
4. Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S.Richgardson.
5. The modern structural theory in Organic Chemistry by L.N.Ferguson, Pretice Hall

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SEMESTER-III

PAPER II- ORGANIC SPECTROSCOPY

Course Objectives:

CO 1: Acquire the knowledge of UV, Infrared, NMR and Mass Spectrocopic techniquesand structural elucidation of organic compounds using the data obtained
CO 2: Understand UV, Infrared, NMR and Mass Spectrocopic techniques and structuralelucidation of organic compounds using the data obtained
CO 3: Apply the knowledge and understanding of new situations UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compoundsusing the data obtained
CO 4: Develop interest in the areas of UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain UV, Infrared, NMR and Mass Spectrocopic techniques and structuralelucidation of organic compounds using the data obtained
LO 2: Interpret UV, Infrared, NMR and Mass Spectrocopic techniques and structuralelucidation of organic compounds using the data obtained
LO 3: Compare UV, Infrared, NMR and Mass Spectrocopic techniques and structuralelucidation of organic compounds using the data obtained
LO 4: Analyse UV, Infrared, NMR and Mass Spectrocopic techniques and structuralelucidation of organic compounds using the data obtained
LO 5: Solve UV, Infrared, NMR and Mass Spectrocopic techniques and structuralelucidation of organic compounds using the data obtained
LO 6: Identify UV, Infrared, NMR and Mass Spectrocopic techniques and structuralelucidation of organic compounds using the data obtained
LO 7: Apply UV, Infrared, NMR and Mass Spectrocopic techniques and structuralelucidation of organic compounds using the data obtained

COURSE CONTENT

UNIT-I: UV SPECTROSCOPY:
UV spectra of aromatic and heterocyclic compounds, α-diketones , β-diketones, enediones and quinines. Applications of UV Specroscopy-study of isomerism, determination of strength of hydrogen bonding and conformations of α-substituted cyclohexanones. Steric effect in biphenyls.

UNIT-II: Infrared Spectroscopy:
Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols, amines, carbonyl compounds, esters, amides, carboxylic acids, anhydrides, lactones, lactums, nitriles and conjugated carbonyl compounds. Effect of hydrogen bonding and solvent on vibrational frequencies.

UNIT-III: Nuclear Magnetic Resonance Spectroscopy (^{1}H NMR):
Nuclear spin, resonance, satuaration, shielding of magnetic nuclei, chemical shifts and its measurements, factors affecting chemical shift, chemical and magnetic equivalence of spins, spin-spin coupling, integration, the coupling constant, types of spin-spin couplings, factors influencing coupling constants, first-order and non-first order spectra, spin system notations (ABX, AMX, ABC, A_2B_2 etc.). Simplification of non-first order spectra- use of higher magnetic fields, nuclear magnetic double resonance and contact shift reagents. Deuterium exchange, Nuclear Overhauser Effect difference spectra, Study of dynamic processes by Variable temperature (VT) NMR, restricted rotation DMF, cyclohexane ring inversion

UNIT-IV: Mass spectroscopy:
Basic Principles, instrumentation, isotope abundance, the molecular ion, metastable ions, base peak, fragment ions, even-electron rule and nitrogen rule. McLafferty rearrangement, ortho effect. *retro*-Diels- Alder reaction, Fragmentation processes- fragmentation associated with various functional groups (alkanes, cycloalkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, phenols, ethers, aldehydes , ketones, esters , carboxylic acids, amides, amines, alkyl chlorides and alkyl bromides.

UNIT-V: Application of UV, IR, NMR and MASS

Structural elucidation of Organic compounds by a combined application of the UV, IR, NMR and MASS spectral data.

Text Books:

1. Spectroscopic identification of organic compounds by RM Silverstein, G C Bassler andT B Morrill
2. Organic Spectroscopy by William Kemp
3. Spectroscopic methods in Organic chemistry by DH Williams and I Fleming
4. Modern NMR techniques for chemistry research by Andrew B Derome
5. NMR in chemistry - A multinuclear introduction by William Kemp
6. Spectroscopic identification of organic compounds by P S Kalsi
7. Introduction to organic spectroscopy by Pavia
8. Carbon-13 NMR for organic chemists by GC Levy and O L Nelson
9. Nuclear Magnetic Resonance Basic principles by Atta-ur-Rahman

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SEMESTER-III

PAPER III – ORGANIC SYNTHESIS

Course Objectives: To make the students

CO 1: Acquire the knowledge of formation of C-C and C=C bonds, organic polymers,unactivated C-H bonds, Asymmetric Synthesis
CO 2: Understand formation of C-C and C=C bonds, organic polymers, unactivated C-Hbonds, Asymmetric Synthesis
CO 3: Apply the knowledge and understanding of formation of C-C and C=C bonds,organic polymers, unactivated C-H bonds, Asymmetric Synthesis to new situations
CO 4: Develop interest in the areas of formation of C-C and C=C bonds, organicpolymers, unactivated C-H bonds, Asymmetric Synthesis

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain formation of C-C and C=C bonds, organic polymers, unactivated C-Hbonds, Asymmetric Synthesis
LO 2: Interpret formation of C-C and C=C bonds, organic polymers, unactivated C-Hbonds, Asymmetric Synthesis
LO 3: Compare formation of C-C and C=C bonds, organic polymers, unactivated C-Hbonds, Asymmetric Synthesis
LO 4: Analyse formation of C-C and C=C bonds, organic polymers, unactivated C-Hbonds, Asymmetric Synthesis
LO 5: Solve formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis
LO 6: Identify formation of C-C and C=C bonds, organic polymers, unactivated C-Hbonds, Asymmetric Synthesis
LO 7: apply formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

COURSE CONTENT

UNIT-I: Formation of Carbon-Carbon (C-C) single bonds:
Alkylations via enolate anions-1,3-diarbonyl and related compounds, direct alkylation of simple enolates, imine and hydrozone anions, enamines. The aldol reaction, umpolung (dipole inversion). Via Organometallic reagents - organ palladium, organo nickel and organo copper reagents

UNIT-II: Formation of carbon-carbon double bonds:

β- Elimination reactions, Pyrolytic *syn* eliminations, alkenes form hydrazones, 1,2-diols, sulfones, sulphoxide-sulphonate rearrangement, the Wittig and related reactions

UNIT-III: Organic Polymers

Introduction to organic polymers, general properties and classification of polymers. Methods of polymerization: (a) Addition polymerization-Definition, synthesis and applications, vulcanization. (b) Condensation polymerization- Definition, synthesis and applications. Radical polymerization. (With at least two examples in each category)

UNIT-IV: Reactions of unactivated carbon-hydrogen bonds

Unactivated carbon-hydrogen bonds: Definition, mechanism and synthetic applications- The Hoffmann-Loeffler-Freytag reaction(HLF reaction)-cyclisation reactions of Nitrenes-theBarton reaction-Photolysis of organic hypohalites, hypochlorites, hypobromites andhypoiodites,

UNIT-V: Asymmetric Synthesis

Topocity – Prochirality – Substrate selectivity – Diastereoselectivity and enantioselectivity – Substrate controlled methods – use of chiral substrates – examples Auxiliary controlled methods – Use of chiral auxiliaries – Chiral enolates – alkylation of chiralimines-Reagent controlled methods – Use of chiral reagents – Asymmetric oxidation – Sharpless epoxidation – Asymmetric reduction – borate reagents.

Text Books:

1. Some Modem Methods of Organic Synthesis W. Carothers, Third Edition, CambridgeUniversity Press, Cambridge, 1988.
2. Modern Synthetic Reactions, Herbert O. House, Second Edition, W.A. BenzamineInc. Menio Park, California, 1972.
3. Principle of Organic Synthesis- R.O.C. Norman and J. M. Coxon.(ELBS)
4. Advanced organic chemistry part A & B; Fourth edition; Francis A Cary and Richard J. Sundberg; Kluwer Academic/Plenum Publisher New York, 2000.
5. Organic chemistry Jonathan Clayden, Nick Geeves, Stuart Warren, 2nd Edition, 2012,Oxford University Press.
6. Stereochemistry of organic compounds — Principles & Applications by D Nasipuri.
7. Stereochemistry of Carbon compounds by Ernest L Eliel & Samuel H. wilen.
8. Stereochemistry: Conformation & Mechanism by P S Kalsi.
9. The third dimension in organic chemistry, by Alan Bassendale.
10. Stereo selectivity in organic synthesis by R S Ward.
11. Asymmetric synthesis by Nogradi.
12. Asymmetric organic reactions by J D Morrison and H S Moschcr.
13. Principles in Asymmetric synthesis by Robert E. Gawley & JEFFREY AUBE.

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SEMESTER-III

PAPER IV – CHEMISTRY OF NATURAL PRODUCTS

Course Objectives:

CO 1: Acquire the knowledge of isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments
CO 2: Understand isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments
CO 3: Apply the knowledge and understanding of new situations isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments
CO 4: Develop interest in the areas of isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments
LO 2: Interpret isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments
LO 3: Compare isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments
LO 4: Analyse isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments
LO 5: Solve isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments
LO 6: Identify isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments
LO 7: Apply isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

COURSE CONTENT

UNIT-I: Antibiotics

Isolation, structure elucidation, stereochemistry, synthesis and biological properties ofPenicillin G, Cephalosporin-C, Streptomycin, Chloramphenicol and Tetracycline

UNIT-II: Terpenes

Isolation, structure elucidation, stereochemistry, synthesis and biological properties ofTerpenes: Forskolin, Taxol and β-amyrin

UNIT-III: Alkaloids

Isolation, structure elucidation, stereochemistry, synthesis, and biological properties of Alkaloids: Morphine, Reserpine and Vincristine

UNIT-IV: Flavonoids

Natural Flavonoids: Apigenin, Flavanones - Hesperetin, Isoflavones - Genistein, Flavonol quercetin, xanthone - Euxanthone.

UNIT-V: Natural Pigments:

Natural Pigments: Introduction structure elucidation and synthesis of quinones-Polyporicacid. Chlorophyll and haemin.

Text Books:

1. Organic Chemistry, Volume 2, Stereochemistry and chemistry of natural products, I.L. Finar, 5th Edition. ELBS.
2. Chemical A spects of Biosynthesis, John Mann, Oxford University Press,Oxford,1996
3. Chemistry of Natural Products. A Unified Approach, N.R. Krishnaswamy,University Press (India) Ltd., Orient Longman Limited, Hyderabad, 1999.
4. Chemistry of Natural Products, S. V. Bhat, Narosa Publishing House, 6th reprint2010.

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Practical Syllabus for III Semester
(w.e.f. 2015-16 admitted batch)

Practical-I: Multi stage organic synthesis

Multistage Organic synthesis involving three or four stages
Paracetamol, 6-Methyluracil, Methyl orange, p-Aminobenzoic acid, Acridone and 2-Iodobenzoic acid

Practical-II: Chromatography and Viva-Voce

1. Thin layer chromatography: Determination of purity of a given sample and identification of unknown organic compounds by comparing the R_f values of known standards.
2. Separation by column chromatography
3. Viva-voce

MODEL QUESTION PAPER

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SEMESTER-III

Paper - I–ORGANIC REACTION MECHANISMS, PERICYCLIC REACTIONS AND PHOTOCHEMISTRY

Answer one question from each Unit
All questions carry equal marks

Time: 3 Hours Max. Marks. 80 (16 x 5 =80)

Unit – I

1. a. Explain Neighbouring group assistance in free radical reactions give examples.

   b. Describe hydroxylation at aromatic carbon by Fentons reagent

   (or)

   a. Discuss about halogenations at an alkyl and allylic carbon with examples.

   b. Write a note on Kolbe and Hunsdiecker reactions.

Unit – II

2. a. Explain E2 elimination reaction with stereo chemical evidence.

   b. Describe Saytzeff and Hoffman elimination rules with examples.

   (or)

   a. Give in a details of E1 and E1CB reactions.

   b. Write a note on Pyrolytic elimination reaction with an examples.

Unit – III

3. a. Explain electrophilic addition reactions on carbon- carbon double bonds.

   b. Write the mechanism of Birch reduction and Tollens reactions.

   (or)

a. Describe carbon- hetero atom multiple bonds addition reactions with examples.

b. Write the mechanism of Mannich reaction and Prins reaction.

Unit – IV

4. a. Sketch MO diagrams of 1,3,5- hexatriene and indicates plane of symmetry, axis of symmetry.

   b. Explain FMOs approach of 4n+2 π electrons system under photochemical condition.

(or)

a. Describe PMOs approach of 2+2 cyclo addition reaction.

b. Write a note on (3,3) and (5,5) sigmatropic rearrangements.

Unit – V

5. a. Explain Patterno-Buchi reaction give examples.

   b. Describe photochemistry of Aromatic compounds with examples.

(or)

a. Write about Norrish type-II cleavage reaction with examples.

b. Explain photochemistry of Olefins give examples.

MODEL QUESTION PAPER

ANDHRA UNIVERSITY

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SEMESTER-III

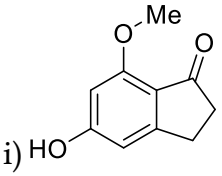
PAPER-II ORGANIC SPECTROSCOPY-I

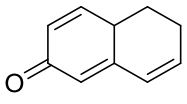
Time: 3 Hours Max Marks: 80

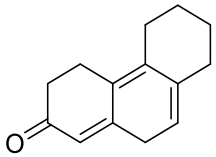
Answer all questions

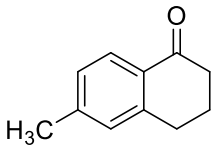
Unit-I

1. a. Calculate the UV maxima for the following compounds 16M

i) 

ii) 

iii) 

iv) 

(or)

b. Write a note on the following

i) Chromophore and auxochrome

ii) Solvent shifts in UV spectroscopy

iii) Woodward rules for calculating $\lambda_{max}$for substituted benzenes

iv) Woodward rules for calculating $\lambda_{max}$of α β unsaturated carbonyl compounds

Unit-II

2. a. How will you distinguish the following pairs of compounds on the basis of IR Spectroscopy 16 M

i) Acetic Acid and methyl formate

ii) Salicylic acid and m-hydroxybenzoic acid

iii) CH_3CH_2COCl and $ClCH_2CH_2OCH_3$

iv) Aniline and benzamide

(or)

b. v) Discuss the characteristic vibrational frequencies of carboxylic acids and ketones

vi) Write a note on fermi resonance and overtones

Unit-III

3 a. Predict the ^{1}H and ^{13}C NMR shifts and multiplicity of the following compounds 16 M
i)Acetamideii) 3-pentanone
iii) p-toludineiv) propanoic acid

or

b. i) Define chemical shift and explain the factors affecting chemical shift
ii) NOE

Unit-IV

4. a. i) How do you differentiate between the following pairs of compounds by mass spectrometry 16 M
a)anisole and p-cresol b)2-butanone and 2-butanal
ii) Give a note onMac-Lafferty rearrangement and Nitrogen rule

(or)

b. Explain the instrumentation of mass spectrometry
c. Explain the mass fragmentation process in alcohols and phenols

Unit-V

5. a. i) An organic compound with molecular formula C_4H_6O give the following spectral data: 16 M
UV_{nm}:λ_{max}218,320
IR cm^{-1} : 285(w), 2740(w), 1700(s), 1650(m)
NMR : 9.7 (d,1H), 6.2 (dd, 1H, J=7 and 17Hz), 6.9 (m, 1H, double quartet), 2.05 (d, 3H)
Deduce the structure of the compound.

ii) An organic compound having molecular formula$C_4H_8O_3$ gives a PMR spectrum that exhibits a triplet at δ1.27, a quartet at δ3.66, a singlet δ10.95. the IR spectrum displays a broad absorption in the range 2500-3000cm^{-1} and a strong peak near 1715cm^{-1}. Deduce structure of the compound

(or)

b. Assign the structure of the compound based on the spectral data

iii) Molecular formula : C_4H_7N
UV :transparent above 200nm

IR cm^{-1} : 2941(m),2270(m),1460(m)
^{1}H NMR : 2.72(septet, J=6.7Hz, 1H), 1.33 (doublet, J=6.7Hz, 6H)

iv) Molecular formula : C_4H_6O
UV_{nm}:λ_{max}218,320
IR cm^{-1} : 285(w), 2740(w), 1700(s), 1650(m)
NMR : 9.7 (d,1H), 6.2 (dd, 1H, J=7 and 17Hz), 6.9 (m, 1H, double quartet), 2.05 (d, 3H)

MODEL QUESTION PAPER

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SEMESTER-III

Paper III – Organic Synthesis

Time: 3hours Max..Marks. 80

Answer ALL questions

All questions carry equal marks.

UNIT-I

1.(a) Give the synthetic applications of Gilman's reagent with examples

(b) What are Enamines? Describe their importance in organic synthesis.

Or

(a) Explain any three methods of formation of C-C single bonds with examples

(b) Discuss the following reactions with mechanism and synthetic applications

(i) Heck reaction (ii) Suzuki coupling

UNIT-II

2. (a) Describe the Stereochemistry and mechanism of E2 elimination reactions.

(b) What is Peterson's olefination reaction? Explain

Or

(a) Give the synthetic applications of the following

(i) Wittig reaction (ii) Shapiro reaction

(b) Explain the following with examples

(i) Sulphoxide-sulphenate rearrangement (ii) β-elimination reactions

UNIT-III

3. (a) What is Radical polymerization? Explain in detail with two examples.

(b)Write notes on Condensation polymers with two examples.

Or

(a) Explain in detail the preparation of any two "Additional polymers".

(b) Explain the following with chemical equations

(i) Vulcanisation (ii) Nylon-6,6

UNIT-IV

4. (a) Give the mechanism of HLF reaction with two examples.

(b) Write notes on the "Cyclisation of Nitrenes" with an example.

Or

(a) Explain in detail the mechanistic features of 'Barton reaction'

(b) Describe the synthesis of various target molecules by photolysis of hypoiodites.

UNIT-V

5. (a) What is Diastereoselectivity? Give examples

(b) Write notes on 'Chiral enolates' with examples

Or

(a) Explain the following with examples

(i) Enantioselectivity (ii) Stereoselective Diel's-Alder reaction

(b) Discuss the following in detail

(i) Topocity (ii) Chiral reagents.

MODEL QUESTION PAPER

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SEMESTER-III

PAPER-IV-Chemistry of Natural Products

Answer one question from each Unit

All questions carry equal marks

Time: 3 Hours

Max.Marks.80 (16x5=80)

UNIT-1

1. a) Describe the structure elucidation of Cephalosporin-C.

   b) Write the synthesis of Penicillin-G & biological properties.

(OR)

   a) Write about Synthesis, biological properties of Cephalosporin-C.

   b) Give a brief note on tetracycline & mention its biological properties.

UNIT-2

2. a) Write the structure elucidation of Forskolin.

   b) Explain the structure elucidation of Taxol.

(OR)

   a) Write about Synthesis of Taxol.

   b) Describe Synthesis of β-Amyrin.

UNIT-3

3. a) Write about Structure elucidation of Morphine.

   b) Describe the Structure elucidation of Reserpine.

(OR)

a) Describe the Synthesis of Vincristine.

b) Write about Synthesis of Morphine.

UNIT-4

4. a) Write about flavones & explain with the Structure elucidation of Apigenin.

b) Describe about flavanones & explain with the Structure of Hesperetin.

(OR)

a) Write a brief note on Isoflavones & explain Synthesis of Genestien.

b) Write a note on Xanthone-Euxanthone & Synthesis of Quercetin.

UNIT-5

5. a) Write a brief note on Chlorophyll.

b) Describe Structure of a haemin.

(OR)

a) Write about Quinones & explain briefly Polyporic acid.

b) How the Structure of Chlorophyll varies from its types. Explain it.

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SEMESTER-IV

PAPER – 1: MODERN SYNTHETIC METHODOLOGY IN ORGANIC CHEMISTRY

Course Objectives:

CO 1: Acquire the knowledge of various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions
CO 2: Understand various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions
CO 3: Apply the knowledge and understanding of new situations various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions
CO 4: Develop interest in the areas of various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain various modern synthetic methods, multicomponent reactions, oxidation,reduction and green chemistry related reactions
LO 2: Interpret various modern synthetic methods, multicomponent reactions, oxidation,reduction and green chemistry related reactions
LO 3: Compare various modern synthetic methods, multicomponent reactions, oxidation,reduction and green chemistry related reactions
LO 4: Analyse various modern synthetic methods, multicomponent reactions, oxidation,reduction and green chemistry related reactions
LO 5: Solve various modern synthetic methods, multicomponent reactions, oxidation,reduction and green chemistry related reactions
LO 6: Identify various modern synthetic methods, multicomponent reactions, oxidation,reduction and green chemistry related reactions
LO 7: Apply various modern synthetic methods, multicomponent reactions, oxidation,reduction and green chemistry related reactions

COURSE CONTENT

UNIT – I: Modern Synthetic Methods

Baylis-Hillman reaction, Henry reaction, Nef reaction, Kulinkovich reaction, Ritter reaction, Sakurai reaction, Tishchenko reaction and Ugi reaction. Brook rearrangement; Tebbe olefination. Metal mediated C-C and C-X coupling reactions: Heck, Stille, Suzuki, Negishi and Sonogashira, Nozaki-Hiyama, Buchwald-Hartwig, Ullmann coupling reaction.

UNIT-II: Multi component Reactions:

Passerini reaction, Biginelli reaction, Hantzsch reaction and Mannich reaction. Metathesis: Grubb's 1st generation and 2nd generation catalyst, Olefin Cross coupling Metathesis (OCM), Ring Closing Metathesis (RCM), Ring Opening Metathesis (ROM) and applications.

UNIT-III: Oxidation

Oxidation: Metal based and non-metal based oxidations of (a) alcohols to carbonyls (Chromium, Manganese, aluminium, silver, ruthenium, DMSO, hypervalent iodine and TEMPO based reagents). (b) phenols (Fremy's salt, silver carbonate) (c) alkenes to epoxides (peroxides/per acids based), Sharpless asymmetric epoxidation, Jacobsen epoxidation, Shi epoxidation.(d) alkenes to diols (Manganese, Osmium based), Sharpless asymmetric dihydroxylation, Prevost reaction and Woodward modification, (e) alkenes to carbonyls with bond cleavage (Manganese, Osmium, Ruthenium and lead based, ozonolysis) (f) alkenes to alcohols/carbonyls without bond cleavage (hydroboration-oxidation, Wacker oxidation, selenium, chromium based allylic oxidation) (g) ketones to ester/lactones (Baeyer-Villiger)

UNIT-IV: Reduction

Reduction: (a) Catalytic hydrogenation (Heterogeneous: Palladium/ Platinum/ Rhodium/ Nickel etc; Homogeneous: Wilkinson). Noyori asymmetric hydrogenation. (b) Metal based reductions using Li/Na/Ca in liquid ammonia, Sodium, Magnesium, Zinc, Titanium and Samarium (Birch, Pinacol formation, McMurry, Acyloin formation, dehalgenation and deoxygenations) (c) Hydride transfer reagents-NaBH4 triacetoxyborohydride, L-selectride, K-selectride, Luche reduction; LiAlH4, DIBAL-H, and Red-Al.

UNIT-V: NEWER METHODS IN ORGANIC SYNTHESIS:

Green Chemistry: Introduction, principles, atom economy and scope (illustrate with two examples) **Microwave induced reactions:** Principle conditions, advantages over conventional heating methods-applications **Ionic liquids:** Introduction and applications in organic synthesis (illustrate with two examples). **Nanomaterials:** Introduction, methods of preparation, applications in organic synthesis **Phase-transfer catalysis:** solid-solid, solid- liquid systems-mechanism of catalytic action, type of catalysts, application in few important reactions

Text Books:

1. Some Modern Methods of Organic Synthesis W. Carothers, Third Edition, CambridgeUniversity Press, Cambridge, 1988.
2. F. A. Cary and R. I. Sundberg, Advanced Organic Chemistry, Part A and B, 5thEdition, Springer, 2009.
3. M. B. Smith, Organic Synthesis, 2nd Edition, 2005
4. J. Tsuji, Palladium Reagents and Catalysts, New Perspectives for the 21st Century,John Wiley & Sons, 2003.
5. I. Ojima, Catalytic Asymmetric Synthesis, 2nd edition, Wiley−VCH, New York,2000.
6. J. Clayden, N. Greeves, S. Warren and P. Wothers, Organic Chemistry, OxfordUniversity Press, 2001.
7. R. Noyori, Asymmetric Catalysis in Organic Synthesis, John Wiley & Sons, 1994.
8. L. Kuerti and B. Czako, Strategic Applications of named Reactions in OrganicSynthesis Elsevier Academic Press, 2005.
9. Green chemistry, Theory and Practical, Paul T.Anastas and John C.Warner.
10. New trends in green chemistry By V.K.Ahulwalia and M.Kidwai.

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SEMESTER-IV

PAPER II - ORGANIC SPECTROSCOPY AND STRUCTURE DETERMINATION OF NATURAL PRODUCTS

Course Objectives:

CO 1: Acquire the knowledge of ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy
CO 2: Understand ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy
CO 3: Apply the knowledge and understanding of new situations ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy
CO 4: Develop interest in the areas of ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CDspectroscopy and structural determination of natural products by spectroscopy
LO 2: Interpret ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CDspectroscopy and structural determination of natural products by spectroscopy
LO 3: Compare ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD andCD spectroscopy and structural determination of natural products by spectroscopy
LO 4: Analyse ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy
LO 5: Solve ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy
LO 6: Identify ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy
LO 7: Apply ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CDspectroscopy and structural determination of natural products by spectroscopy

COURSE CONTENT

UNIT-I: ^{13}C NMR spectroscopy

Introduction, ^{13}C-chemical shifts, factors affecting the chemical shifts, chemical shifts of organic compounds. Calculation of chemical shifts of alkanes, alkenes and aromatic compounds. Types of 13C NMR spectra: Proton-coupled, proton- decoupled and OFF- resonance decoupled (ORD) spectra, DEPT. ^{13}C-NMR solvents:

UNIT-II: Heteronuclear NMR spectroscopy & Electron Spin Resonance Spectroscopy (ESR): Heteronuclear couplings: ^{13}C-^{1}H, ^{13}C-D, ^{13}C-^{19}F, ^{13}C-^{31}P.^{1}H-D, ^{1}H-^{19}F, ^{1}H-^{31}P, ^{1}H-^{15}N
ESR Spectroscopy: Principles, hyperfine splitting

UNIT-III: NMR Instrumentation, 2D-NMR techniques
NMR Instrumentation: Types of NMR Spectrometers-Continuous Wave (CW)-NMR, Fourier Transform (FT)-NMR, NMR solvents, sample preparation
2D-NMR techniques: Principles of 2D NMR, Correlation spectroscopy (COSY) HOMO COSY (1H-1H COSY), Hetero COSY (^{1}H, ^{13}C COSY, HMQC), long range ^{1}H,^{13}C COSY (HMBC), NOESY and 2D-INADEQUATE experiments and their applications.

UNIT-IV: Optical Rotatory Dispersion (ORD) and CD Spectroscopy:
Optical rotation, circular birefringence, and circular dichroism and Cotton effect. Plain curves and anomalous curves. Empirical and semiempirical rules-The axial haloketone rule, the octant rule, Application of the rules to the study of absolute configuration and conformationsof organic molecules.

UNIT-V: Structure Determination of Natural Products by Spectral Methods
Sructure elucidation - Spectroscopic techniques IR, UV, ^{1}H-NMR, ^{13}C-NMR, COSY, HETEROCOSY, and MS- natural products - Examples, flavones - Apigenin, flavanones-Hesperetin, isoflavones - Genistein, coumarins-7-hydroxycoumarin, alkaloids - morphine, quinine, terpenoids - (-)-Menthol, Steroids - stigmasterol, Glycosides - salicin (Alcoholic β-glucoside)

Text books:

1. Spectroscopy, fourth edition, D. L Pavia, G. M Lampman CENGAGE Learning, 2012
2. Spectroscopic Methods in Organic Chemistry. Forth Edition D. M. Williams and I. Fleming Tata - McGraw Hill, New Delhi, 1990. For all spectral methods except ORD and CD and ESR.
3. Organic Spectroscopy, Second Edition, W. Kemp, ELBS Macmillan, 1987 for ORD and CD and ESR.
4. Chemistry of natural products, S. V. Bhat, Narosa Publishing House, 6th reprint 2010 (For IV th unit)
5. Applications of absorption spectroscopy of Organic Compounds J.R. Dyer, Prentice Hall of India, New Delhi, 1984.
6. Spectrometric identification of Organic Compounds, Fourth Edition, R.M. Silverstein: G.C.Vassiellr and T.C. Merill, Johne Willey, Singapore, 1981.
7. For ORD and CD "Applications of Optical rotation and Circular Dichroism", G.C. Barret, in "Elucidation of Organic structures by Physical and Chemical Methods" Part I (Eds)
8. K.W. Bentley and G.W.Kirty John Wiley, 1972, Chapter VIII (only those aspects mentioned in the syllabus).

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SEMESTER-IV

PAPER – III: DESIGNING ORGANIC SYNTHESIS AND SYNTHETIC APPLICATIONS OF ORGANO- BORANES AND SILANES

Course Objectives:

CO 1: Acquire the knowledge of the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

CO 2: Understand the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

CO 3: Apply the knowledge and understanding of new situations the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

CO 4: Develop interest in the areas of the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain the principles of disconnection approach, synthetic strategies for one groupand two group disconnection, organoboranes and organosilanes

LO 2: Interpret the principles of disconnection approach, synthetic strategies for onegroup and two group disconnection, organoboranes and organosilanes

LO 3: Compare the principles of disconnection approach, synthetic strategies for onegroup and two group disconnection, organoboranes and organosilanes

LO 4: Analyse the principles of disconnection approach, synthetic strategies for one groupand two group disconnection, organoboranes and organosilanes

LO 5: Solve the principles of disconnection approach, synthetic strategies for one groupand two group disconnection, organoboranes and organosilanes

LO 6: Identify the principles of disconnection approach, synthetic strategies for one groupand two group disconnection, organoboranes and organosilanes

LO 7: Apply the principles of disconnection approach, synthetic strategies for one groupand two group disconnection, organoboranes and organosilanes

COURSE CONTENT

UNIT-I: Disconnection Approach – Principles Introduction, Terminology: Retrosynthesis, Target Molecule (TM), synthon, synthetic equivalent,functional group interconversion (FGI). Linear and convergent synthesis. Criteria for selection oftarget . Order of events in retrosynthesis with reference to Salbutamol, Proparcaine and Dopamine. Chemoselectivity, Regioselectivity, reversal of polarity and cyclizations. Protecting groups- Principles of protection of alcohols, amine, carbonyl and carboxyl groups

UNIT-II: Synthetic Strategies - One group Disconnections[12 Hours] Introduction to one group disconnections: C-C disconnection-alcohols and carbonyl compounds; C-X disconnections- alcohols and carbonyl compounds and sulphides two group C-C and C-X Disconnections.

UNIT-III: Synthetic Strategies - Two group Disconnections[12 Hours] Introduction to Two group C-C disconnections; Diels-Alder reaction, 1,5- difunctionalised compounds, Michael addition and Robinson annulation. Two group C-X disconnections; 1, 1- difunctionalised, 1, 2-difunctionalised and 1, 3-difunctionalised compounds. Control in carbonyl condensations, explanation with examples oxanamide and mevalonic acid.

UNIT –IV: Organoboranes

Hydroboration- Preparation of Organoboranes. Reagents – dicylohexyl borane, disiamyl borane, thexyl borane, 9-BBN and mono-, di-isopinocamphenyl borane. Functional group transformations of Organo boranes-Oxidation, protonolysis and rearrangements. Formation of carbon-carbon-bonds viz organo boranes- carbonylation, cyanoboration.

UNIT –V: Organosilanes

Preparation and synthetic applications of trimethylsilyl chloride, dimethyl-t-butylsilyl chloride, trimethylsilylcyanide, trimethylsilyliodide and trimethylsilyltriflate. Protection of functional groups - Trimethylsilylethers, Silylenolethers. Synthetic applications of α-silyl carbanions, β-silyl carbonium ions. Peterson's olefination.

Text Books:

1. Organic syntheses via boranes / Herbert C. Brown; with techniques by Gary W.Kramer,
2. Alan B. Levy, M. Mark Midland. New York : Wiley, 1975
3. Some Modern Methods of Organic Synthesis W. Carothers, Third Edition, CambridgeUniversity Press, Cambridge, 1988.
4. Organic Synthesis: The disconnection approach, S. Warrant John Wiley & sons, NewYork, 1984.
5. Modern Synthetic Reactions, Herbert O. House, Second Edition, W.A. BenzamineInc. Menio Park, California, 1972.
6. Principle of Organic Synthesis- R.O.C. Norman and J. M. Coxon.(ELBS)
7. Organic Synthesis: Special techniques. V.K.Ahulwalia and Renu Aggarwal.
8. Organic Synthesis by C Willis and M Willis
9. Problems on organic synthesis by Stuart Warren

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SEMESTER-IV

PAPER IV-DRUG DESIGN AND DRUG CHEMISTRY

Course Objectives:

CO 1: Acquire the knowledge of drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs, antineoplastic drugs, cardiovascular drugs, oral hypoglycaemic drugs, local anti-infective and antiviral drugs
CO 2: Understand drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs, antineoplastic drugs, cardiovascular drugs, oral hypoglycaemic drugs, local anti-infective and antiviral drugs
CO 3: Apply the knowledge and understanding of new situations drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs, antineoplastic drugs, cardiovascular drugs, oral hypoglycaemic drugs, local anti-infective and antiviral drugs
CO 4: Develop interest in the areas of drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs, antineoplastic drugs, cardiovascular drugs, oral hypoglycaemic drugs, local anti-infective and antiviral drugs

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain drugs, their classification, drug metabolism and drug development,Structure Activity Relationship in drugs
LO 2: Interpret drugs, their classification, drug metabolism and drug development,Structure Activity Relationship in drugs
LO 3: Compare drugs, their classification, drug metabolism and drug development,Structure Activity Relationship in drugs
LO 4: Analyse drugs, their classification, drug metabolism and drug development,Structure Activity Relationship in drugs
LO 5: Solve drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs
LO 6: Identify drugs, their classification, drug metabolism and drug development,Structure Activity Relationship in drugs
LO 7: Apply drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

COURSE CONTENT

UNIT I: Introduction to Drugs
General Classification, nomenclature, drug metabolism. Development of drugs: Procedure followed in drug design, concepts of lead compound lead modification, concept of prodrugs, Structure Activity Relationship (SAR)-factors affecting bio-activity-resonance, inductive effect, isosterism, bio-isosterism, spatial considerations, Quantitative Structure Activity Relationships (QSAR)-Concepts of drug receptors. Elementary treatment of drug receptor interactions. Physico-chemical parameters: lipophilicity, partition coefficient, electronic ionization constants, steric, Shelton and surface activity parameters and redox potentials.

UNIT II: Antineoplastic Agents:
Introduction, classification-alkylating agents- mechanism and mode of action, nitrogen mustards-synthesis, properties, uses and dosage - Chlorambucil, cyclophosphamide and melphalan. Antimetobolites- synthesis, properties, uses and dosage-pyrimidine analogues-5- flurouracil, purine analogues-6-mercaptopurine, folic acid analogues-Methotrexate. Antibiotics-structure, properties and dosage-Doxorubicin, Mitomycin.

UNIT III: Cardiovascular Drugs: Introduction, cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output. Direct acting arteriolar dilators. Synthesis of amyl nitrate, sorbitrate, diltiazem, quinidine, verapamil, methyldopa, atenolol, oxyprenolol.

UNIT IV: Oral Hypoglycaemic Drugs:

Introduction, Classification, Sulphonylureas- synthesis, mode of action, properties, uses and dosage- tolbutamide, glipizide. Biguanides- synthesis, mode of action, properties, uses and dosage-Metformin. α-glucosidage inhibitors- synthesis, mode of action, properties, uses and dosage- Miglitol. Dipeptidyl Peptidase-4 (DPP-4) inhibitors- synthesis, mode of action, properties, uses and dosage-saxagliptin and sitaglipti

UNIT V: Local Anti-infective & Antiviral drugs

Local Anti-infective Drugs: Introduction and general mode of action. Synthesis of sulphonamides, ciprofloxacin, norfloxacin, dapsone, amino salicylic acid, isoniazid, fluconazole, econozole and chloroquin.

Antiviral Drugs: Introduction, classification based on mechanism of action, Nucleoside or Nucleotide Reverse Transcriptase Inhibitors (NRTIs)-Synthesis, metabolism, properties and uses and dosage-Acyclovir, Zidovudine (Anti-HIV agent). Non-Nucleoside or Nucleotide Reverse Transcriptase Inhibitors (NNRTIs)-Synthesis, metabolism, properties and uses and dosage-Nevirapine, Efavirenz. Protease Inhibitors (PIs)- Synthesis, metabolism, properties and uses and dosage-Indinavir. CCR5-Inhibitors- Synthesis, metabolism, properties and uses and dosage-Maraviroc

Text Books:

1. Textbook of medicinal chemistry, Volume1&II,ThirdeditionbyV Alagarsamy, CBS-publishers
2. Introduction to Medicinal Chemistry, A Gringuage, Wiley-VCH.
3. Wilson and Gisvold's Text Book of Organic Medicinal and PharmaceuticalChemistry, Ed Robert F. Dorge.
4. An Introduction to Drug Design, S. S. Pandeya and J. R. Dimmock, New AgeInternational.
5. Burger's Medicinal Chemistry and Drug Discovery, Vol-1 (Chapter.-9 and Ch-14),Ed. M. E. Wolff, John Wiley.
6. Goodman and Gilman's Pharmacological Basis of Therapeutics, McGraw-Hill.
7. The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman, AcademicPress.

Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley

ANDHRA UNIVERSITY
SCHOOL OF CHEMISTRY
Department of Organic Chemistry & FDW
Revised Syllabus for Organic Chemistry Specialization
(With effect from the Admitted batch of 2021-2022 Academic Year)
Practical syllabus for IV Semester
(w.e.f. 2015-16 admitted batch)

Practical-I: Organic mixture analysis

Separation of two component mixtures by chemical methods and their identification by chemical reactions — separation by using solvent ether, 5 % aqueous sodium bicarbonate, 5% sodium hydroxide and dil hydrochloric acid, checking the purity of the two components by TLC, identification of the compounds by a systematic study of the physical characteristics (mp/bp), extra elements (nitrogen, halogens and sulfur), solubility, functional groups, preparation of crystalline derivatives and identification by referring to literature. A minimum of 5 mixtures should be separated and analyzed by these procedures.

Practical-II: Estimations and Isolation

A) Estimation of the following compounds

i) Glucose ii) Phenol iii) Aniline iv) Aspirin (titrimetry) v) Ibuprofen (titrimetry)

B) Isolation of the following compounds

i) Caffeine from tea leaves (solvent extraction) ii) Piperine from pepper (Soxhlet extraction)

ii) Lycopene from tomato

Books Suggested :

1 A text book of practial Organic chemistry by A.I. Vogel, ELBS and Longman group.

2.Practical Organic chemistry by Mann and Saunders, ELBS and Longman group

3.Laboratory Manual of Organic Chemistry by Raj K Bansal

MODEL QUESTION PAPER

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SEMESTER-IV

Paper - I – MODERN SYNTHETIC METHODOLOGY IN ORGANIC CHEMISTRY

Answer one question from each Unit
All questions carry equal marks

Time: 3 Hours Max. Marks. 80 (16 x 5 =80)

Unit – I

1. a. Explain Baylis-Hillman reaction give examples.

   b. Discuss about Metal mediated C-X coupling reaction with an example.

   (or)

   a. Write the mechanism of the following :

      i) Ritter reaction

      ii) Brook rearrangement.

   b. Write a note on Metal mediated C-C coupling reaction with an example

Unit – II

2. a. Briefly explinBiginelli reaction

   b. Describe Olefin Cross coupling Metathesis (OCM)

   (or)

   a. Give in a details of Mannich reaction

   b. Write a note on Ring Opening Metathesis (ROM) with an example.

Unit – III

3. a. Describe oxidation of alcohols to carbonyl compounds.

   b. Write the mechanism of Jacobsen and Shi epoxidation reactions.

   (or)

   a. Explain alkenes to carbonyls with bond cleavage reaction with examples.

   b. Give the mechanism of the following:

      i) Hydroboration-oxidation

      ii) Baeyer-Villiger oxidation

Unit – IV

4. a. Write a note on Heterogeneous hydrogenation give examples

   b. Explain DIBAL-H and Red-Al.

   (or)

   a. Describe Homogeneous hydrogenation give suitable examples.

   b. Write a note on Hydride transfer reagents with an examples

Unit – V

5. a. Explain principles, atom economy and scope of **Green** Chemistry.

   b. Describe any two methods of preparation and applications of Nano materials

(or)

a. Write about Microwave induced reactions

b. Explain Phase-transfer catalysis give applications.

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SEMESTER-IV

PAPER-II ORGANIC SPECTROSCOPY AND STRUCTURE DETERMINATION OF NATURAL PRODUCTS

Time:3 Hours Max Marks: 80

Answer one question from each Unit
All questions carry equal marks

UNIT-I

1. a. Explain in detail about types of ^{13}C NMR spectra 16M

or

b. Define ^{13}C chemical shift and explain about various factors affecting chemical shifts

UNIT-II

2. a. Describe about the following 16M
i) ^{13}C - ^{19}F and ii) ^{13}C – ^{31}P

or

b. Explain in detail about hyperfine splitting

UNIT-III

3. a. Write a note on the following: 16 M
i) CW-NMR
ii) NMR solvents

or

b. Write an account on the following
i) COSY
ii) HETCOR

UNIT-IV

4. a. Explain the following with suitable examples
i) Explain about cotton effect 16 M
ii) Discuss about circular birefringence and circular dichroism

Or

b. Write absolute configuration of R(+)-3-methyl cyclohexanone by
i) the application of octant rule.
ii) Explain about axial halo ketone rule

UNIT-V

5. a. Explain the spectral properties of Genistein and Apigenin 16 M

Or

b. Explain the spectral properties of 7-hydroxycoumarin and Menthol

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SEMESTER-IV

Paper III – Designing organic synthesis and synthetic applications of organo boranes and silanes

Answer one question from each Unit
All questions carry equal marks

Time : 3 hrs Max Marks: 80

UNIT-I

5x16=80 M

1. (a) Explain the following with examples

   (i) Synthon (ii) Reagent

   (b) Discuss " Reversal of polarity" with two examples

Or

(a) Discuss the order of events involved in retrosynthesis of "Salbutamol"

(b) Describe "convergent synthesis" with examples

UNIT-II

2. (a) Describe one group 'C-C' disconnections of alcohols with examples.

   (b) Explain C-X one group disconnections of carbonyl with examples

Or

(a) Discuss one group 'C-X' disconnections of sulphides with examples

(b) Write a general note on two group 'C-C' and 'C-X' disconnections with examples

UNIT-III

3. (a) Explain two group 'C-X' disconnections in 1,1-, 1,2- and - difunctionalised compounds with examples.

   (b) Explain the control in "carbonyl condensations" with examples

Or

(a) Describe the disconnections approach of oxanamide and mevalonic acid

(b) Explain the retrosynthesis involved in "Michael addition" reactions with examples

UNIT-IV

4. (a) What is Hydroboration ? Explain with examples

   (b) Write the synthetic utility of the following

   (i) thexyl borane (ii) 9 - BBN

Or

(a) Explain Hydroboration - carbonylation with examples

(b) Discuss formation of C-C single bonds through organoboranes with examples

UNIT-V

5. (a) Describe the synthetic importance of 'Trimethyl silyl chloride' with examples

   (b) Explain 'Petersons olefination' reaction with examples

Or

(a) Give the synthetic applications of 'α-silyl carbanions' with examples

(b) Explain the Organosilanes as protecting groups in organic synthesis.

MODEL PAPER

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SEMESTER-IV

PAPER-IV- Drug Design and Drug Chemistry

Answer one question from each Unit
All questions carry equal marks

Time: 3 Hours **Max.Marks.80 (16x5=80)**

1. a) (i) What are Physicochemical parameters of a drug? Explain in brief the following parameters? a) Surface Activity b) Redox potential

(ii) What is a Prodrug? Explain its advantages with suitable examples?

(OR)

b) (i) Explain Structure Activity Relationship (SAR)? Describe the effect of Resonance and Bio-isosterism on bio-activity?

(ii) Explain the concept of Drug Receptor Interactions?

2. a) (i) What are Nitrogen Mustards? Explain the Synthesis, Mode of action, Properties, Uses and dosage of a)Melphalan b) Chlorambucil.

(ii) What are Antibiotics? Explain the synthesis, Mode of action, Properties, uses and dosage of a) Mitomycin b) Doxorubicin.

(OR)

b) (i) Explain the synthesis, mode of action, Properties, Uses and dosage of a) Methotrexate b) 5-Flourouracil.

(ii) Explain the Synthesis, mode of action, Properties, Uses of a) Cyclophosphamide b) 6-Mercaptopurine.

3. a) (i) Write the Synthesis, mode of action, Properties, uses and dosage of a) Sorbitrate b) Methyldopa

(ii) What are Cardiovascular drugs and disease? Explain the classification of Cardiovascular drugs?

(OR)

b) (i) Explain the Synthesis, mode of action, Properties, uses and dosage of a) Amyl nitrate b) Diltiazem

(ii) Write the synthesis, mode of action, properties and uses of a) Verapamil b) Quinidine

4. a) (i) What are Dipeptidyl Peptidase-4 (DPP-4) inhibitors? Explain the Synthesis, mode of action, Properties, uses and dosage of a) Saxagliptin b) Sitagliptin.

(ii) Explain the synthesis, mode of action, properties, uses and dosage of Miglitol.

(OR)

b) (i) Explain the Synthesis, mode of action, Properties, uses and dosage of
a) Glipizide b) Tolbutamide

(ii) What are Oral Hypoglycemic drugs? Write the synthesis, mode of action, properties, uses and dosage of Metformin.

5) a) (i) What are CCR5 inhibitors? Write the Synthesis, metabolism, properties and uses of Maraviroc?

(ii) What are Local Anti infective Drugs? Write the synthesis of
a) Sulphonamides b) Ciprofloxacin.

(OR)

b) (i) Write the synthesis, metabolism, properties, uses and dosage of
a) Acyclovir b) Zidovudine.

(ii) Write the synthesis of a a) Amino Salicyclic Acid b) Econozole.