DEPARTMENT OF CHEMISTRY

GOVT. DIGVIJAY P. G. AUTONOMOUSCOLLEGE, RAJNANDGAON
(C.G.)

SYLLABUS

V and VI SEMESTER

FYUGP Chemistry

(Approved by Board of Study for 2024-25)

COURSE					
Sem	Course	Title of the Paper	Theory + Tutorials + Practical (Credit)	Marks (ESE + IA)	Total Marks
I	DSC-1	Inorganic Chemistry - I	3 + 0 + 0	80 + 20	100
	DSC-1Lab	Inorganic Chemistry – I LabCourse	0 + 0 + 1	40 + 10	50
	GE - 1	General Inorganic Chemistry - I	3 + 0 + 0	80 + 20	100
	GE – 1Lab	General Inorganic Chemistry – I Lab Course	0 + 0 + 1	40 + 10	50
	SEC - 1	Basics of Soil and Water Analysis - I	2 + 0 + 0	40 + 10	50
II	DSC-2	Organic Chemistry - I	3 + 0 + 0	80 + 20	100
	DSC-2Lab	Organic Chemistry – I Lab Course	0 + 0 + 1	40 + 10	50
	GE – 2	General Organic Chemistry - I	3 + 0 + 0	80 + 20	100
	GE – 2Lab	General Organic Chemistry – I Lab Course	0 + 0 + 1	40 + 10	50
	SEC - 2	Basics of Soil and Water analysis - II	2 + 0 + 0	40 + 10	50
III	DSC-3	Physical Chemistry - I	3 + 0 + 0	80 + 20	100
	DSC-3Lab	Physical Chemistry – I Lab Course	0 + 0 + 1	40 + 10	50
	DSE - 1	Coordination Chemistry	3 + 0 + 0	80 + 20	100
	DSE – 1Lab	Coordination Chemistry Lab Course	0 + 0 + 1	40 + 10	50
	SEC- 3	Good Laboratory practices and Calibration in Chemistry - I	2 + 0 + 0	40 + 10	50
IV	DSC-4	Organic Chemistry - II	3 + 0 + 0	80 + 20	100
	DSC-4Lab	Organic Chemistry - II Lab Course	0 + 0 + 1	40 + 10	50
	DSE – 2	Electrochemistry	3 + 0 + 0	80 + 20	100
	DSE – 2Lab	Electrochemistry Lab Course	0 + 0 + 1	40 + 10	50
	SEC - 4	Good Laboratory practices and Calibration in Chemistry - II	2 + 0 + 0	40 + 10	50
V	DSC-5	Inorganic Chemistry - II	3 + 0 + 0	80 + 20	100
	DSC-5Lab	Inorganic Chemistry - II Lab Course	0 + 0 + 1	40 + 10	50
	DSE – 3	Heterocyclic Chemistry	3 + 0 + 0	80 + 20	100
	DSE – 3Lab	Heterocyclic Chemistry Lab Course	0 + 0 + 1	40 + 10	50
	GE – 3	General Physical Chemistry - I	3 + 0 + 0	80 + 20	100
	GE – 3Lab	General Physical Chemistry - I Lab Course	0 + 0 + 1	40 + 10	50
	SEC- 5	Green Methods in Chemistry-I	2 + 0 + 0	40 + 10	50
VI	DSC-6	Physical Chemistry - II	3 + 0 + 0	80 + 20	100
	DSC-6Lab	Physical Chemistry - II Lab Course	0 + 0 + 1	40 + 10	50
	DSE – 4	Polymer Chemistry	3 + 0 + 0	80 + 20	100

	DSE – 4Lab	Polymer Chemistry Lab Course	0 + 0 + 1	40 + 10	50
	GE – 4	Chemistry in Daily Life	3 + 0 + 0	80 + 20	100
	GE – 4Lab	Chemistry in Daily Life Lab Course	0 + 0 + 1	40 + 10	50
	SEC- 6	Green Methods in Chemistry-II	2 + 0 + 0	40 + 10	50

ESE- End Semester Exam, IA-Internal Assessment

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

Four Year UnderGraduate Programme (FYUGP) Session 2024-25

Major – Chemistry

Session: 2024-25	Program: B.Sc.
Semester: V	Subject: Chemistry
Course Type: DSC 5	Course Code:
Course Title:	**Inorganic Chemistry-II**
Credit: 4	Lecture: 60
M.M. : 100 = (ESE 80+IA 20)	Minimum Passing Marks: 40

Title	Inorganic Chemistry-II
Course Objectives	Students will have a basic knowledge of liquid state, ionic equilibria, concept of acid-base and non-aqueous solvents.
Learning Outcomes	**Unit 1-** Students will develop an understanding about the Oxidation and reduction and nuclear chemistry. **Unit 2 -** Students will have an insight look about Lanthanides and actinides. **Unit 3-** Students will have an insight about the Organometallic chemistry. **Unit 4 -** Students will understand about the catalysis reactions of organometallic compounds and bioinorganic chemistry.

Units	Lectures	Topics
I	15	**A. Oxidation and Reduction** Redox potential, balancing redox reactions, Latimer's law. Frost Latimer and Pourbaix diagram principles involving extraction of the elements. **B. Nuclear chemistry**: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis
II	15	**Chemistry of Inner Transition Metals** **Chemistry of Lanthanides** Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds. **Chemistry of Actinides** General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from uranium, similarities between the later actinides and the later lanthanides.

III	15	**Organometallic Chemistry** Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18-electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. π- acceptor behavior of CO (MO diagram of CO to be discussed). Zeise's salt: Preparation and structure.
IV	15	**A. Catalysis by Organometallic compounds:** Alkene hydrogenation (Wilkinsons Catalyst) and Polymeration of ethane using Ziegler – Natta Catalyst **B. Bio-Inorganic Chemistry** Essential and trace elements in biological processes, Excess and deficiency of some trace metals, Toxicity of some metal ions (Hg, Pb, Cd and As), metalloporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to Ca2+ and Mg2+, nitrogen fixation.

List of Books	• J. D. Lee: A new Concise Inorganic Chemistry, E L. B. S. • F. A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley. • Douglas, McDaniel and Alexader: Concepts and Models in Inorganic Chemistry, John Wiley. • G. M. Barrow: Physical Chemistry Tata McGraw-Hill (2007). • G. W. Castellan: Physical Chemistry 4th Edn. Narosa (2004). • C. Kotz, P. M. Treichel& J. R. Townsend: General Chemistry CengageLening India Pvt. Ltd., New Delhi (2009). • H. Mahan: University Chemistry 3rd Ed. Narosa (1998). • R. H. Petrucci: General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985). • F. Shriver and P. W. Atkins: Inorganic Chemistry, Oxford University Press. • Gary Wulfsberg: Inorganic Chemistry, Viva Books Pvt. Ltd.

8/2/2023 25/5/23

Inorganic Chemistry-II Lab

Session: 2024-25	Program: B.Sc.
Semester: V	Subject: Chemistry
Course type: DSC5LAB	Course Code:
Course Title :	**Inorganic Chemistry-II**
MM: 50 (40 + 10)	Minimum Passing Marks: 20

List of Practicals

Volumetric analysis

(a) Determination of acetic acid in commercial vinegar using NaOH.
(b) Determination of alkali content-antacid tablet using HCl.
(c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
(d) Estimation of hardness of water by EDTA.
(e) Estimation of ferrous & ferric by dichromate method.
(f) Estimation of copper using thiosulphate.

Paper chromatographic separation offollowing metal ions: i. Ni (II) and Co (II) ii. Fe (III) and Al (III)

Gravimetric analysis:

a) Estimation of nickel (II) using Dimethylglyoxime (DMG).
b) Estimation of copper as CuSCN
c) Estimation of iron as Fe_2O_3 by precipitating iron as $Fe(OH)_3$.
d) Estimation of Al (III) by precipitating with oxine and weighing as $Al(oxine)_3$ (aluminium - oxinate).
e) Estimation of Barium as BaSO4

List of Books	◦ Vogels Qualitative Inorganic Analysis, A.I. Vogel, Prentice Hall, 7th Edition. ◦ Vogels Quantitative Chemical Analysis, A.I. Vogel, Prentice Hall, 6th Edition. ◦ Mendham, J., A. I. Vogel's Quantitative Chemical Analysis Sixth Edition, Pearson, 2009. ◦ Svehala G. and Sivasankar I. B, Vogel's Qualitative Inorganic Analysis, Pearson, India, 2012

25/5/24 25/5/24

	Departmental members	
Chairperson /H.O.D 25/5/24		
Subject Expert ..... A. Assistant Professor (University Nominee)	1.....	8.....
Subject Expert	2.....	9.....
	3.....	10.....
Representative ..... (Industry)	4.....	11.....
	5.....	12.....
Representative ..... (Alumni)	6.....	13.....
Representative ..... (Professor Science Faculty Other Dept.)	7.....	14.....

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

Four Year Under Graduate Programme (Session 2024-25)

Major - Chemistry

Heterocyclic Chemistry	
Session: 2024-25	Program: B.Sc.
Semester: V	Subject: Chemistry
Course Type: DSE	Course Code:
Course Title:	**Heterocyclic Chemistry**
Credit: 4	Lecture: 60
M.M. : 100 = (ESE 80 + IA 20)	Minimum Passing Marks: 40%

Title	Heterocyclic Chemistry
Course Objectives	Students will have a basic knowledge of Three-membered heterocycles, Four-membered heterocycles, Five-membered aromatic heterocycles, Condensed five-membered Heterocycles.
Learning Outcomes	**Unit 1-** Students will develop an understanding about the Three-membered heterocycles. **Unit 2 -** Students will have an insight look about Four-membered heterocycles. **Unit 3-** Students will have an insight comparative study of Five-membered aromatic heterocycles. **Unit 4 -** Students will understand about Condensed five-membered Heterocycles.

Unit	Number of Lectures	Content
I	15	Introduction, structure and systematic nomenclature of heterocyclic compounds **Three-membered rings** with one heteroatom: Chemistry of oxiranes, aziridines and episulphides - synthetic approaches and reactivities.

		Three-membered heterocycles with two heteroatoms: oxaziranes, diaziridines and diazirines - synthetic approaches and reactivities.
II	15	**Four-membered heterocycles**: oxitanes, 'azatidanes and thietanes - synthetic approaches and reactivities. natural products:synthesis of Peniciline and cephalosporine.
III	15	**Five-membered aromatic heterocycles:** 1. With one heteroatom: furans, pyrroles and thiophenes - general synthetic approaches, properties and reactivities. 2. With two heteroatoms: oxazoles, isoxazoles, imidazoles, thiazoles, pyrazoles and isothiazoles - general synthetic approaches and reactivities. 3. With three and four heteroatoms: triazoles and tetrazoles - synthetic approaches, properties and reactivity.
IV	15	**Condensed five-membered Heterocycles:** Benzofuran, indoles and benzothiazoles - general synthetic approaches, with greater emphasis on the chemistry of Indoles

Reference Books

- Heterocyclic Chemistry, J.A. Joule, K. Mills, Wiley, 2010.
- The Essence of heterocyclic Chemistry. A. R. Parikh, H. Parikh, R. Khunt, New Age Int. Publication,
- Principles of Modern Heterocyclic Chemistry, L. A. Paquette, W. A. Benjamin, New York, 1968.
- Heterocyclic Chemistry, J.A. Joule and G. F. Smith, van Nostrand, London, 1978.
- Comprehensive Heterocyclic Chemistry. The structure, reactions, synthesis and use of Heterocyclic compounds, (Ed. A.R. Katritzky and C. W. Rees),. Vol 1-8, Pergamon Press, 1984.
- Handbook of Heterocyclic Chemistry, A. R. Katritzky, Pergamon Press, 1985.
- Van der plas, H. C. Ring transformations of Heterocycles, Vols 1 and 2, Academic Press, 1974.

Heterocyclic Chemistry Lab	
Session: 2024-25	Program: B.Sc.
Semester: V	Subject: Chemistry
Course Type: DSE LAB	Course Code:
Course Title:	**Heterocyclic Chemistry Lab**
M.M. : 50 = (40 + 10)	Minimum Passing Marks: 20

1. Identification of hetero atoms (S, N, X) in given organic compounds in lab.
2. Identification/separation of simple organic compounds containing hetero atoms using column chromatorgapy/TLC) in lab.
3. Spectroscopic identification of simple organic compounds (spectra may be provided to the students and teachers may help the students to identify the compounds using spectra). Melting point/boiling point of the compounds may be checked for its purity.
4. Preparation of : Indigo (using aldol condensation reaction of 2-nitrobenzaldehyde with acetone in basic condition);

(Depending upon laboratory facilities, more preparation of heterocyclic group of compounds may be incorporated by teacher).

List of Books	• Vogels Qualitative Inorganic Analysis, A.I. Vogel, Prentice Hall, 7th Edition. • Vogels Quantitative Chemical Analysis, A.I. Vogel, Prentice Hall, 6th Edition. • Mendham, J., A. I. Vogel's Quantitative Chemical Analysis Sixth Edition, Pearson, 2009. • Svehala G. and Sivasankar I. B, Vogel's Qualitative Inorganic Analysis, Pearson, India, 2012. • T. W. Graham Solomon: Organic Chemistry, John Wiley and Sons. • Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman. • E. L. Eliel: Stereochemistry of Carbon Compounds, Tata McGraw Hill. I. L. Finar: Organic Chemistry (Vol. I & II), E. L. B. S. • R. T. Morrison & R. N. Boyd: Organic Chemistry, Prentice Hall. • Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand.

25/5/24

	Departmental members	
Chairperson /H.O.D 25.5.24		
Subject Expert ..... (University Nominee)	1.....	8.....
Subject Expert.....	2.....	9.....
	3.....	10.....
Representative ..... (Industry)	4.....	11.....
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	7.....	14.....
Representative ..... (Professor Science Faculty Other Dept.)		

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

B. Sc. (Multiple Major) - Degree COURSE (Session 2024-25)

Major - Chemistry

Session: 2024-25	Program: B.Sc.
Semester: V	Subject: Chemistry
Course Type: GE	Course Code:
Course Title:	**General Physical Chemistry - I**
Credit: 4	Lecture: 60
M.M. : 100 = (ESE 80 + IA 20)	Minimum Passing Marks: 40%

Title	General Physical Chemistry - I
Course Objectives	Students will have a basic knowledge of liquid state, colloidal state, solids and solutions.
Learning Outcomes	**Unit 1-** Students will develop an understanding about the Liquid state and Colloidal State. **Unit 2 -** Students will have an insight look about Gaseous state. **Unit 3-** Students will have an insight of Solid state. **Unit 4 -** Students will understand about Solutions.

Units	Lectures	Topics
I	15	**Liquid state:** Structure and physical properties of liquids; vapour pressure, surface tension, viscosity, and their dependence on temperature, Effect of addition of various solutes on surface tension, cleansing action of detergents. Structure of water. **Colloidal State** Classification, optical, kinetic and electrical properties of colloid Coagulation Hardy Schulze law, Flocculation value, Protection, Gold number, Emulsion, Micelle, Gel, Syneresis and Thixotrophy, Application of colloids
II	15	**Gaseous state** Characteristics of gaseous state, gas laws, idea gas equation, postulates of

		Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation.
III	15	**Solid state** Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X Ray diffraction by crystals, Braggs law. Structures of NaCl, and CsCl (qualitative treatment only). Defects in crystals.
IV	15	**Solutions** Ideal and non ideal solutions, modes of representing concentration of solutions, activity and activity coefficient. Dilute solution: Colligative properties, lowering of vapour pressure of solvent, Roults law, osmosis, Vant Hoff theory of dilute solution measurements of Osmotic pressure, relationship between lowering of vapour pressure & osmotic pressure. Elevation of boiling point, Depression in freezing point, abnormal molar masses, depression of dissociation and association of solutes, Vant Hoff factor.

List of Books	• G. M. Barrow: Physical Chemistry Tata McGraw-Hill (2007). • G. W. Castellan: Physical Chemistry 4th Edn. Narosa (2004). • C. Kotz, P. M. Treichel & J. R. Townsend: General Chemistry Cengage Lening India Pvt. Ltd., New Delhi (2009). • H. Mahan: University Chemistry 3rd Ed. Narosa (1998). • R. H. Petrucci: General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985). • D. Lee: A New Concise Inorganic Chemistry, E.L.B.S. • F.A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley. • F. Shriver and P. W. Atkins: Inorganic Chemistry, Oxford University Press. • Gary Wulfsberg: Inorganic Chemistry, Viva Books Pvt. Ltd.

25/5/24

General Physical Chemistry Lab

Session: 2024-25	Program: B.Sc.
Semester: V	Subject: Chemistry
Course type: GE LAB	Course Code:
Course Title :	**General Physical Chemistry Lab**
MM: 50 (40 + 10)	Minimum Passing Marks: 20

List of Practicals

Viscosity & Surface Tension

1. To determine the % compositions of a given mixture (Non interacting system) by viscosity method.
2. To determine the viscosity of amyl alcohol in water at different concentrations & calculate the excess viscosity of these solutions.
3. To determine the % composition of a given binary mixture by surface tension method (acetone & ethyl methyl ketone).

Conductance

1. To determination of cell constant.
2. To determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
3. To perform the following conductometric titrations:
   i. Strong acid vs. strong base.
   ii. Weak acid vs. strong base.

Potentiometry

To perform the following potentiometric titrations:

i. Strong acid vs. strong base.

ii. Weak acid vs. strong base.

iii. Potassium dichromate vs. Mohr's salt.

List of Books	• A.I. Vogel: Textbook of Practical Organic Chemistry, Prentice Hall, 5th Edn. • F. G. Mann & B. C. Saunders: Practical Organic Chemistry, Orient Longman, 1960. • B.D. Khosla: Senior Practical Physical Chemistry, R. Chand & Co. • Ahluwalia, V.K. & Agarwal, R. Comprehensive Practical Organic Chemistry, Universities Press.

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	Departmental members	
Chairperson /H.O.D 23/5/24		
Subject Expert ..... (University Nominee)	1.....	8.....
Subject Expert.	2.....	9.....
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GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

Four Year Under Graduate Programme (Session 2024-25)

Major - Chemistry

Session: 2024-25	Program: B.Sc.
Semester: V	Subject: Chemistry
Course Type: SEC	Course Code:
Course Title:	**Green Methods in Chemistry-I**
Credit: 2	Lecture: 30
M.M. : 50 (40 + 10)	Minimum Passing Marks: 40%

Title	Green Methods in Chemistry-I
Course Objectives	• To inspire the students about the chemistry which is good for human health and environment. • To evaluate suitable technologies for the remediation of hazardous substances. • To acquire the knowledge of the twelve principles of green chemistry and how to apply in green synthesis. • To make students aware about the benefits of using green chemistry.
Learning Outcomes	By the end of this course, students will be able to: • Think to design and develop materials and processes that reduce the use and generation of hazardous substances in industry. • Get ideas of innovative approaches to environmental and societal challenges. • Know how chemicals can have an adverse/potentially damaging effect on human and vegetation. • Critically analyse the existing traditional chemical pathways and processes and creatively think about bringing environmentally benign reformations in these protocols. • Convert biomass into valuable chemicals through green technologies.

Units	Lectures	Topics
I	8	**Introduction** Definition of green chemistry and how it is different from conventional chemistry and environmental chemistry. Need of green chemistry Importance of green chemistry in- daily life, Industries and solving human health problems (four examples each). Twelve principles of Green Chemistry Green Chemistry and Challenges Green Chemistry Awareness Initiative Green Chemistry Challenge Awards Green Chemistry in India Typical Real World Cases of Green Chemistry
II	7	**Renewable Energy Sources** Introduction Biomass Energy, types of biomass, conversion of biomass, impact on climate and environment Bio-fuels, types, biodiesel, green diesel, biogasoline, biogas, biodigesters Solar Energy, production of thermal and electrical energy, application in daily life, solar cells Wind Energy, resources, production, turbines Hydro power, harnessing the hydro power, disadvantages and limitations, applications Geothermal energy, types, geothermal wells, environmenal effects

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III	8	**Prevention of Chemical Accidents** **Hazardous Chemical Symbols and Precautions** **Pecautions and first aid during Chemical Accidents** Designing greener processes Inherent safer design and its subdivision : minimization, simplification, substitution, moderation and limitation. Greener alternative to Bhopal Gas Tragedy (safer route to carcarbaryl) and Flixiborough accident (safer route to cyclohexanol)
IV	7	**Future Trends in Green Chemistry** Oxidizing reagents and Catalysts Biomimetic synthesis is with examples of alkaloid tropinone and biocatalysts, multifunctional reagents Solventless reactions, advantages and limitations, examples such as halogenation, Michael addition, Aldol condensation, Grignard reaction, Reformatsky reaction, Claisen Rearrangement Combinatorial Green Chemistry Green Chemistry in Sustainable Development

List of Books	• Anastas, P.T.; Warner, J.C.(1998), Green Chemistry, Theory and Practice, Oxford University Press. • Lancaster, M.(2016),Green Chemistry An Introductory Text.2nd Edition, RSC Publishing. • Cann , M. C.; Umile, T.P. (2008), Real world cases in Green chemistry Vol 11, American Chemical Society, Washington. • Matlack, A.S.(2001),Introduction to Green Chemistry, Marcel Dekker. • Ryan, M.A.; Tinnesand, M. (2002), Introduction to Green Chemistry (Ed), American Chemical Society, Washington DC.

	Departmental members	
Chairperson /H.O.D		
Subject Expert ..... (University Nominee)	1.....	8.....
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GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

Four Year UnderGraduate Programme (FYUGP) Session 2024-25

Major - Chemistry

Session: 2024-25	Program: B.Sc.
Semester: VI	Subject: Chemistry
Course Type: DSC 6	Course Code:
Course Title:	**Physical Chemistry-II**
Credit: 4	Lecture: 60
M.M. 100 = (ESE 80+IA 20)	Minimum Passing Marks: 40

Title	Physical Chemistry-II
Course Objectives	Students will have a basic knowledge of aliphatic hydrocarbons, cycloalkanes and conformational analysis, aromatic hydrocarbons and halogenated hydrocarbons.
Learning Outcomes	**Unit 1-** Students will have an insight of solutions and colligative properties. **Unit 2 -** Students will understand about chemical equilibrium. **Unit 3-** Students will have a basic idea aboutchemical kinetics. **Unit 4 -** Students will have an insight view about phase equilibrium and Nerst distribution law.

Units	Lectures	Topics
I	15	**Solid State Chemistry** Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, Seven crystal systems and fourteen Bravais Lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method, Crystal defects
II	15	**Colloids and Surface Chemistry** Classification, Optical, Kinetic and Electrical properties of colloids, Coagulation, Hardy Schulze Law, Flocculation value, Protection, Gold number, Emulsion, Micelles and types, Gel, Synthesis and thixotrophy, application of colloids Physical absorption, chemisorptions, adsorption isotherms (Langmuir and Freundlich), Nature of adsorbed state, Qualitative discussion of BET
III	15	**Chemical Kinetics** Rate of reaction, Factors influencing rate of reaction, rate law, rate

		constant, Order and molecularity of reactions, rate determining step, Zero, First and Second order reactions: Rate and Rate law, Methods of determining order of reaction, Chain reactions Temperature dependence of reaction rate, Arrhenius theory, Physical significance of Activation energy, Collision theory, demerits of collision theory, non mathematical concept of transition state theory
IV	15	**Phase Equilibrium and Nerst Equation** A. Phase rule,Phase,component and degree of freedom, derivation of Gibbs phase rule,Clausius-claperon equation and its application to solid - Liquid,Liquid -Vapor and solid Vapor, limitation of phase rule, applications of phase rule to one component system: Water system and sulphur system Application of phase rule to two component system: Pb-Ag system, Zn-Mg system ,Ferric chloride-water system, desilveriaztion of lead, congruent and incongruent, melting point and eutectic point, Three component system: Solid solution liquid pairs B. Nerst distribution law, Henry's law, application, solvent extraction

List of Books	• G. M. Barrow: Physical Chemistry Tata McGraw-Hill (2007). • G. W. Castellan: Physical Chemistry 4th Edn. Narosa (2004). • C. Kotz, P. M. Treichel& J. R. Townsend: General Chemistry CengageLening India Pvt. Ltd., New Delhi (2009). • H. Mahan: University Chemistry 3rd Ed. Narosa (1998). • R. H. Petrucci: General Chemistry 5th Ed. Macmillan Publishing Co.: New York (1985). • F.A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley. • F. Shriver and P. W. Atkins: Inorganic Chemistry, Oxford University Press. • Puri, B. R., Sharma, L. R. and Pathania, M. S., Principles of Physical Chemistry, S Chand Publishers (2010) • Gary Wulfsberg: Inorganic Chemistry, Viva Books Pvt. Ltd.

Physical Chemistry-II Practical

Session: 2024-25	Program: B.Sc.
Semester: VI	Subject: **Physical Chemistry-II Practical**
Course type: DSC 6 LAB	Course Code:
Credit: 01	Lecture : 20
MM: 50	Minimum Passing Marks: 20

List of Practicals

A. Surface Tension measurements

1. Determine surface tension by (i) drop number (ii) drop weight method
2. Surface tension composition curve for a binary liquid mixture.
3. To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl methyl ketone).

B. Chemical Kinetics

1. To determine the specific rate of hydrolysis of methyl/ethyl acetate catalysed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester
3. To compare the strength of HCl and H_2SO_4 by studying the kinetics of hydrolysis of ethyl alcohol

C. Colloids

1. To prepare colloidal solution of silver nanoparticles (reduction method) and other metal nanoparticles using capping agents

List of Books	• .I. Vogel: Textbook of Practical Organic Chemistry, Prentice Hall, 5th Edn. • F. G. Mann & B. C. Saunders: Practical Organic Chemistry, Orient Longman, 1960. • B.D. Khosla: Senior Practical Physical Chemistry, R. Chand & Co. • Ahluwalia, V.K. & Agarwal, R. Comprehensive Practical Organic Chemistry, Universities Press.

25/5/24

	Departmental members	
Chairperson /H.O.D 25/5/24		
Subject Expert ..... (University Nominee)	1.....	8.....
Subject Expert.....	2.....	9.....
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Representative ..... (Professor Science Faculty Other Dept.)	7.....	14.....

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

Four Year Under Graduate Programme (Session 2024-25)

Major - Chemistry

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)	
Polymer Chemistry	
Session: 2024-25	Program: B.Sc.
Semester: VI	Subject: Polymer Chemistry
Course type: DSE	Course Code:
Credit: 04	Lecture : 60
MM: 100 (80 + 20)	Minimum Passing Marks: 40%

Title	Polymer Chemistry
Course Objectives	Students will have a basic knowledge of Polymers, Polymeric Structure and Property Relationship, Polymerization Chemistry, Polymer Processing and Polymer additives.
Learning Outcomes	**Unit 1-** Students will develop an understanding about the Polymers. **Unit 2 -** Students will have an insight look about Polymeric Structure and Property Relationship. **Unit 3-** Students will have an insight comparative study of Polymerization Chemistry. **Unit 4 -** Students will understand about Polymer Processing and Polymer additives.

Unit	Number of Lectures	Content
I	15	**Introduction** Polymer, monomer, examples of polymers, biopolymers, classification, polymerization process, degree of polymerization, condensation, addition polymers, kinetics of addition polymerization process
II	15	**Polymeric Structure and Property Relationship** Structure of polymers - Linear, branched, cross linked, and network

		polymers, molecular weight (number average, weight average, viscosity average) and distribution of molecular weight, polydispersity index, crystallinity in polymer, melting temperature and glass transition temperature, Volumetric properties - molar volume, density, Van der Waals volume – Coefficient of linear thermal expansion and volumetric thermal expansion - Pressure volume temperature (PVT) relationship.
III	15	**Polymerization Chemistry** Industrial methods of polymerization such as a bulk, solution, emulsion, suspension. Stereochemistry of polymers and stereo-specific polymerization, Catalysts-their utility in polymers and stereo-specific polymerizations, Catalysts their utility in polymer manufacture, Zieglar-Natta, Metallocene and others.
IV	15	**Polymer Processing** Plastics Thermosetting plastics, elastomers, fibres, compounding Processing techniques Calendering, diecasting, rotational casting, film casting, injection moulding, blow moulding, extrusion moulding, compression moulding, thermoforming, foaming, reinforcing, fibre spinning **Polymer additives** Types of fillers, miscellaneous mineral fillers, plasticizers, antioxidants, UV-stabilizers and absorbers, fire retardants, colourants

Reference Books

- D.W. Van Krevelen and P.J. Hoftyzen, "Properties Of Polymer, 3rd Edition Elsevier Scientific, Publishing Company Amsterdam - Oxford - Newyork. 1990.
- J.E. Mark Ed.AIP, Physical Properties Of Polymers Hand Book, Williston, Vt, 1996.
- Reaction Engineering of Step Growth Polymerization, S K Gupta and Anil Kumar, Plenum Press, 1987
- Odian; George, Principles of Polymerization, McGraw-Hill Book Co., New York (1970).
- W. Billmeyer, Text book of polymer science, 3rd Edn., 2007, Wiley.
- J.R.Fried, Polymer Science and Technology, (2005), PHI publication.

25/5/24

Polymer Chemistry Lab	
Session: 2024-25	Program: B.Sc.
Semester: VI	Subject: Chemistry
Course Type: DSE LAB	Course Code:
Course Title:	**Polymer Chemistry Lab**
M.M. : 50 = (40 + 10)	Minimum Passing Marks: 20

List of suggested laboratory practicals

1.Free radical solution polymerization of any one: Styrene, methylmethacrylate, methyl acrylate, methacrylic acid (using free radical initiators). (purification of monomer should be taught)

2. Preparation of phenol-formaldehyde resins

3. Emulsion polymerization of polymethylmethacrylate.

4. Use of viscometer for molecular weight determination – (any known polymer, example: polyvinyl pyrrolidone in water/polyacrylamide in $NaNO_2$ solution) by viscometry. (students should be explained regarding principles and use of ubblohde/ostwald viscometer).

5. Estimation of amount of HCHO in a given solution by sodium bisulphite method.

List of Books	• Vogels Qualitative Inorganic Analysis, A.I. Vogel, Prentice Hall, 7th Edition. • Vogels Quantitative Chemical Analysis, A.I. Vogel, Prentice Hall, 6th Edition. • Mendham, J., A. I. Vogel's Quantitative Chemical Analysis Sixth Edition, Pearson, 2009. • Svehala G. and Sivasankar I. B, Vogel's Qualitative Inorganic Analysis, Pearson, India, 2012. • T. W. Graham Solomon: Organic Chemistry, John Wiley and Sons. • Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman. • E. L. Eliel: Stereochemistry of Carbon Compounds, Tata McGraw Hill. I. L. Finar: Organic Chemistry (Vol. I & II), E. L. B. S. • R. T. Morrison & R. N. Boyd: Organic Chemistry, Prentice Hall. • Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, S. Chand.

	Departmental members	
Chairperson /H.O.D 28/5/24		
Subject Expert ..... (University Nominee)	1.....	8.....
Subject Expert.	2.....	9.....
	3.....	10.....
Representative ..... (Industry)	4.....	11.....
	5.....	12.....
Representative ..... (Alumni)	6.....	13.....
	7.....	14.....
Representative ..... (Professor Science Faculty Other Dept.)		

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

B. Sc. (Multiple Major) - Degree COURSE (Session 2024-25)

Major - Chemistry

Session: 2024-25	Program: B.Sc.
Semester: VI	Subject: Chemistry
Course Type: GE	Course Code:
Course Title:	**CHEMISTRY IN DAILY LIFE**
Credit: 4	Lecture: 60
M.M. : 100 = (ESE 80 + IA 20)	Minimum Passing Marks: 40%

Title	CHEMISTRY IN DAILY LIFE
Course Objectives	Students will have a basic knowledge of Food additives, Vitamins, Oils and fats, Polymers, Paints, Pigments and Dyes.
Learning Outcomes	**Unit 1-** Students will develop an understanding about the Food additives, adulterants and contaminants, Flavours, Artificial food colorants and Modern Food Habits. **Unit 2** - Students will have an insight look about Vitamins, Oils and fats. **Unit 3-** Students will have an insight of preparation, properties Polymers. **Unit 4** - Students will understand about different properties & structures of Paints, Pigments and Dyes.

Units	Lectures	Topics
I	15	**Food additives, adulterants and contaminants-** Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose and sodium cyclamate. **Flavours:** Vanillin, alkyl esters (fruit flavours) and monosodium glutamate. **Artificial food colorants:** Coal tar dyes and non-permitted colours and metallic salts. Analysis of pesticide residues in food. **Modern Food Habits:** Definition and health effects of fast foods, instant

		foods, dehydrated foods and junk foods. Harmful effects of modern food habits. Importance of milk, coconut water and Neera
II	15	**Vitamins**: Classification and Nomenclature. Sources, deficiency diseases and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1. **Oils and fats**: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like aregemone oil and mineral oils.
III	15	**Polymers** : Types and classification of polymers. Source and general characteristics of natural and synthetic polymers. Typical examples of polymers used as plastics, in textiles, in electronic and automobile components, in the medical and aerospace materials. Problems of plastic waste management. Strategies for the development of environment friendly polymers.
IV	15	**Paints & Pigments:** White pigments (white lead, ZnO, lithopone, TiO_2). Blue, red, yellow and green pigments. Paints and distempers: Requirement of a good paint. Emulsion, latex; luminescent paints. Fire retardant paints and enamels, lacquers. Solvents and thinners for paints. **Dyes:** Colour and constitution (electronic concept). Classification of dyes. Methods of applying dyes to the fabrics. A general study of azo dyes, Mordant brown, Congo red and methyl orange.

List of Books	• B. K. Sharma: introduction to Industiral Chemistry, Goel Publishing, Meerut (1998) • Medicinal Chemistry by Ashtoush Kar. • Analysis of Foods – H.E. Cox: 13. Chemical Analysis of Foods – H.E. Cox and Pearson. • Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4th ed. New Age International (1998) • Physical Chemistry – P W Atkins and J. de Paula – 7 th Ed. 2002, Oxford University Press. • Organic Chemistry by I. L. Finar, Vol. 1 & 2. 9. Polymer Science and Technology, J. R. Fired (Prentice Hall)

21/3/24

CHEMISTRY IN DAILY LIFE LAB

Session: 2024-25	Program: B.Sc.
Semester: VI	Subject: CHEMISTRY
Course type: GE LAB	Course Code:
Course Title :	CHEMISTRY IN DAILY LIFE LAB
MM: 50 (40 + 10)	Minimum Passing Marks: 20

List of Practicals

1. Determination of R_f-values and identification of organic compounds through paper chromatography.
2. Determination of R_f-values and identification of organic compounds through thin layer chromatography.
3. Determination of iodine and saponification values of oil sample.
4. Determination of the pK_a of indicators spectrophotometically.
5. Detection of the presence of adulterant in given food sample: milk and milk products, oils and fats, food grains, spices, etc.
6. Analysis of pesticide residues in food.
7. Preparation and determination of properties of polymers and biopolymers.

List of Books	• A.I. Vogel: Textbook of Practical Organic Chemistry, Prentice Hall, 5th Edn. • F. G. Mann & B. C. Saunders: Practical Organic Chemistry. Orient Longman, 1960. • B.D. Khosla: Senior Practical Physical Chemistry, R. Chand & Co. • Ahluwalia, V.K. & Agarwal, R. Comprehensive Practical Organic Chemistry, Universities Press. • A.I. Vogel, Qualitative Inorganic Analysis, Prentice Hall, 7th Edn

	Departmental members	
Chairperson /H.O.D 25/5/24		
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GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

Four Year Under Graduate Programme (Session 2024-25)

Major - Chemistry

Session: 2024-25	Program: B.Sc.
Semester: VI	Subject: Chemistry
Course Type: SEC (Project Based)	Course Code:
Course Title:	**Green Methods in Chemistry-II**
Credit: 2	Lecture: 30
M.M. : 50 (40 + 10)	Minimum Passing Marks: 40%

Marking Scheme :

Project	30 Marks
Internal	10 Marks
Viva	10 Marks
Total	50 Marks

NOTE : Questions will be asked from all the units in the internal evaluation exam.

Title	Green Methods in Chemistry-II
Course Objectives	• To inspire the students about the chemistry which is good for human health and environment. • To evaluate suitable technologies for the remediation of hazardous substances. • To make students aware of how chemical processes can be designed, developed and run in a sustainable way. • To acquire the knowledge of the twelve principles of green chemistry and how to apply in green synthesis. • To make students aware about the benefits of using green chemistry. • To have the idea of Biocatalytic Process-Conversion of Biomass into chemicals.
Learning Outcomes	By the end of this course, students will be able to: • Get idea of toxicology, environmental law, energy and the

	environment • Think to design and develop materials and processes that reduce the use and generation of hazardous substances in industry. • Think of chemical methods for recovering metals from used electronics materials. • Get ideas of innovative approaches to environmental and societal challenges. • Know how chemicals can have an adverse/potentially damaging effect on human and vegetation. • Critically analyse the existing traditional chemical pathways and processes and creatively think about bringing environmentally benign reformations in these protocols. • Convert biomass into valuable chemicals through green technologies.

Units	Lectures	Topics
I	8	**Green Metrics** Introduction and need of Green Metrics, mass based versus impact based metrics Percentage Yield, excess reactant factor, Atom economy, carbon economy, drawbacks of these analysis Reaction Mass Efficiency, significance in showing greenness of a reaction, Effective Mass Yield, drawbacks Environmental factor, E-factors of various chemical industries such as oil refining and pharmaceutical industries Eco Scale, Mass Intensity, Metrices of Green Chemistry, introduction, varoius matrices of green chemistry and sustainability
II	7	**Green Solvents** Classification, physical properties, Role of solvent Solvent free processes, Water as solvent, Super critical fluids, Ionic liquids, cationic and anionic liquids, Fluorous solvents, Solvents obtained from renewable sources, Solvents obtained from carbohydrates such as ethanol, bioethanol, THFF, Solvents obtained from lipids such as FMAEs, glycerol, etc.

III	8	**Catalysis** Introduction, types of catalysis, homogenous and heterogenous catalytic reaction Catalysis in Organic Synthesis, principleof green chemical catalysis Catalysis by Solid Acids and Bases, acid catalysed classification of carboxylic acids and alcohols Asymmetric catalysis, three pillars of assymetric catalysis viz., bio-, metal- and organocatalysis, applications of Asymmetric catalysis Phase Transfer Catalysis, types and applications Photocatalysis Biocatalysis
IV	7	The following Real-world Cases in green chemistry should be discussed: Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments. Designing of environmentally safe marine antifoulant. Rightfit pigment: Synthetic azo pigments to replace toxic organic and inorganic pigments. An efficient, green synthesis of a compostable and widely applicable plastic (polylactic acid) made from corn.

List of Books	• Anastas, P.T.; Warner, J.C.(1998), Green Chemistry, Theory and Practice, Oxford University Press. • Lancaster, M.(2016),Green Chemistry An Introductory Text.2nd Edition, RSC Publishing. • Cann , M. C.; Umile, T.P. (2008), Real world cases in Green chemistry Vol 11, American Chemical Society, Washington. • Matlack, A.S.(2001),Introduction to Green Chemistry, Marcel Dekker. • Ryan, M.A.; Tinnesand, M. (2002), Introduction to Green Chemistry (Ed), American Chemical Society, Washington DC.

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