

### Scheme of B. Sc. Chemistry

Year	Course Code	Subject Name	Theory/ Practical	Total Credit	Total Marks	
					Max	Min
First year	CHEM-1T	Inorganic and Physical Chemistry	Theory	4	50	17
	CHEM-2T	Organic and Physical Chemistry	Theory	4	50	17
	CHEM-1P	LAB 1 : General Chemistry-1	Practical	2	50	17
Second year	CHEM-3T	Inorganic and Physical Chemistry	Theory	4	50	17
	CHEM-4T	Organic and Physical Chemistry	Theory	4	50	17
	CHEM-2P	LAB 2 : General Chemistry-2	Practical	2	50	17
Third year	CHEM-5T	Inorganic and Physical Chemistry	Theory	4	50	17
	CHEM-6T	Organic and Physical Chemistry	Theory	4	50	17
	CHEM-3P	LAB 3 : General Chemistry-3	Practical	2	50	17

**Note:** There shall be four extra credits in each year for internship/apprenticeship. The certificate of extra credits for this would be provided by the concern university and it is not mandatory.



Part A: Introduction			
Program: <b>Degree Course</b>		Class: <b>B.Sc. III Year</b>	Year: <b>2024</b> Session: <b>2024-25</b>
1	Course Code	<b>CHEM-3P</b>	
2	Course Title	<b>LAB. 3: GENERAL CHEMISTRY 3</b>	
3	Course Type	<b>Chemistry Practical</b>	
4	Pre-requisite (if any)	To study this course our students must have had the diploma in chemistry or equivalent	
5	Course Learning Outcomes (CLO)	At the end of this course, the students will learn the following aspects of laboratory exercises : <ul style="list-style-type: none"> <li>• Preparation of inorganic complexes</li> <li>• Preparation of organic compounds</li> <li>• Explain /define different terms in conductometry</li> <li>• Explain/define different terms in colorimetry</li> <li>• Understand the theoretical principles with the help of practicals</li> </ul>	
6	Credit Value	<b>Practical : 02</b>	
7	Total Marks	<b>Max. Marks: 50</b>	<b>Min. Passing Marks: 17</b>

Part B: Content of the Course		
Total No. of Lectures: <b>30</b>		
LABORATORY COURSE		No. of Lectures
<b>Tentative list of practical</b>	<b>Inorganic Chemistry</b> Gravimetric analysis: Estimation of nickel (II) using dimethylglyoxime (DMG), estimation of copper as CuSCN, estimation of iron as Fe <sub>2</sub> O <sub>3</sub> by precipitating iron as Fe(OH) <sub>3</sub> , estimation of Al (III) by precipitating with oxine and weighing as Al(oxine) <sub>3</sub> (aluminium oxinate), estimation of Barium as BaSO <sub>4</sub> . Inorganic Preparations: •Tetraamminecopper (II) sulphate, [Cu(NH <sub>3</sub> ) <sub>4</sub> ]SO <sub>4</sub> .H <sub>2</sub> O •Cis and trans K[Cr(C <sub>2</sub> O <sub>4</sub> ) <sub>2</sub> . (H <sub>2</sub> O) <sub>2</sub> ] Potassium dioxalatodiaquachromate(III) •Tetraamminecarbonatocobalt (III) ion •Potassium tris(oxalate)ferrate(III)/ Sodium tris(oxalate)ferrate(III) •Cu(I) thiourea complex, bis (2,4-pentanedionate) zinc hydrate; Double salts (Chrome alum/ Mohr's salt)	10
	<b>Organic chemistry</b> 1.Preparation of organic Compounds: Synthesis of oxalic acid from cane sugar. Acetylation of one of the following compounds: amines (aniline, o-, m-, p- toluidines and o-,m-, p-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) Benzoylation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-, panisidine) and one of the following phenols (β-naphthol, resorcinol, p cresol) by Schotten-Baumann reaction. Bromination of any one of the following: <b>a.</b> Acetanilide by conventional methods <b>b.</b> Acetanilide using green approach (Bromate-bromide method)	10

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	<ul style="list-style-type: none"> <li>• Nitration of any one of the following:               <ol style="list-style-type: none"> <li>a. Acetanilide/nitrobenzene by conventional method</li> <li>b. Salicylic acid by green approach (using ceric ammonium nitrate).                   <ul style="list-style-type: none"> <li>• Reduction of p-nitrobenzaldehyde by sodium borohydride.</li> <li>• Hydrolysis of amides and esters.</li> </ul> </li> </ol> </li> <li>• Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.</li> <li>• Benzylisothiuronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid)</li> <li>• Aldol condensation using either conventional or green method.</li> <li>• Benzil-Benzilic acid rearrangement.</li> <li>• Preparation of sodium polyacrylate.</li> <li>• Preparation of urea formaldehyde.</li> <li>• Preparation of methyl orange.</li> </ul> <p>The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, melting point and TLC.</p> <ol style="list-style-type: none"> <li>1. Qualitative Analysis: Qualitative analysis of an organic mixture containing two solid components using water, <math>\text{NaHCO}_3</math>, <math>\text{NaOH}</math> for separation and preparation of suitable derivatives.</li> <li>2. Extraction of caffeine from tea leaves.</li> <li>3. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.</li> <li>4. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy. (Spectra to be provided).</li> <li>5. Estimation of glycine by Sorenson's formalin method.</li> <li>6. Study of the titration curve of glycine.</li> <li>7. Estimation of proteins by Lowry's method.</li> <li>8. Study of the action of salivary amylase on starch at optimum conditions</li> <li>9. Effect of temperature on the action of salivary amylase.</li> </ol>	
	<p><b>Physical chemistry</b></p> <p><b>Conductometry</b></p> <ul style="list-style-type: none"> <li>• Determination of cell constant</li> <li>• Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.</li> <li>• Perform the following conductometric titrations:               <ol style="list-style-type: none"> <li>i. Strong acid vs. strong base</li> <li>ii. Weak acid vs. strong base</li> <li>iii. Mixture of strong acid and weak acid vs. strong base</li> <li>iv. Strong acid vs. weak base</li> </ol> </li> <li>• To determine the strength of the given acid conductometrically using standard alkali solution.</li> <li>• To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically</li> <li>• To study the saponification of ethyl acetate conductometrically.</li> </ul> <p><b>Potentiometry/pH metry:</b></p> <ul style="list-style-type: none"> <li>• Perform the following potentio/pH metric titrations:               <ol style="list-style-type: none"> <li>i. Strong acid vs. strong base</li> <li>ii. Weak acid vs. strong base</li> </ol> </li> </ul>	<p>10</p>

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	iii. Dibasic acid vs. strong base iv. Potassium dichromate vs. Mohr's salt v. Determination of pK <sub>a</sub> of monobasic acid UV/ Visible spectroscopy: <ul style="list-style-type: none"> <li>• Verify Lambert-Beer's law and determine the concentration of CuSO<sub>4</sub>/KMnO<sub>4</sub>/K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> in a solution of unknown concentration</li> <li>• Determine the concentrations of KMnO<sub>4</sub> and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> in a mixture.</li> <li>• Study the kinetics of iodination of propanone in acidic medium.</li> <li>• Determine the amount of iron present in a sample using 1,10-phenanthroline.</li> <li>• Determine the dissociation constant of an indicator (phenolphthalein).</li> <li>• Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.</li> <li>• Study of pH-dependence of the UV-Vis spectrum (200-500 nm) of potassium dichromate.</li> <li>• Spectral characteristics study (UV) of given compounds (acetone, acetaldehyde, acetic acid, etc.) in water.</li> <li>• Absorption spectra of KMnO<sub>4</sub> and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> (in 0.1 M H<sub>2</sub>SO<sub>4</sub>) and determine λ<sub>max</sub> values.</li> </ul> Note: Experiments may be added/deleted subject to availability of time and facilities	
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**Keywords:** Gravimetric analysis, Inorganic complex preparation, Organic compounds, Conductometry, Potentiometric, pH metry, Spectroscopy.

#### Part C : LEARNING RESOURCES

##### Suggested Readings:

1. Vogel, A.I. Quantitative Organic Analysis, Part 3, Pearson (2012).31
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
3. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
4. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
5. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000),
7. Manual of Biochemistry Workshop, 2012, Department of Chemistry, University of Delhi
8. Green Chemistry, ,Theory and Practice,P.T.AnastasandJ.C.Warner
9. Green Chemistry ,Environmental friendly alternatives ,R.S.Sanghli and M.M. Srivastava, Narosa Publications.
10. Gupta, A., Unified Chemistry Practical, Navbodh Publications.

##### E-Learning Resources:

1. <http://vlab.amrita.edu/index.php>
2. <http://www.chemguide.co.uk/>

Fundamental Chemistry related topics on SWAYAM platform and E-pathshala

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**Part D: Assessment and Evaluation**

Maximum Marks: 50

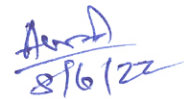
<b>Experiments</b>	<b>08 hours / M.M. 50</b>
Five Experiments to be performed	
Inorganic chemistry – Two experiments to be performed . a) Gravimetric Estimation compulsory. b) Anyone experiment from synthesis and analysis.	08 marks 04 marks
Organic chemistry – Two experiments to be performed. a) Qualitative analysis of organic mixture containing two solid components.	08 marks (03 marks for each compound and 02 marks for separation)
b) One experiment from synthesis of organic compound	04 marks
Physical chemistry – one experiment from physical chemistry	12 marks
Sessional	04 marks
Viva	10 marks
[Note ; In case of Ex-student , one mark each will be added to gravimetric analysis and qualitative analysis of organic mixture and two marks in experiment in physical chemistry].	

**DECLARATION**

This is to certify that the syllabus is framed by the Central Board of Studies (Chemistry) as per the guidelines (TOR) of the Department of Higher Education, Raipur Chhattisgarh.

1. Dr. Alka Shrivastav,  
Assistant Professor,  
Govt. E.V.P.G. College, Korba
2. Smt. Priyanka Tiwari,  
Assistant Professor,  
Govt. J.P. Verma P.G. College, Bilaspur
3. Mr. Vijay Kumar Lahare,  
Assistant Professor,  
Govt. Lahiri P.G. College Chirimiri(C.G.)

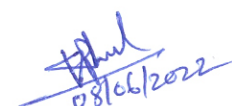
- Chairman

  
8/6/22

- Member



- Member

  
08/06/2022

4. Dr. Rajmani Patel,  
Assistant Professor,  
Hemchand Yadav University, Durg
5. Dr. A.K. Singh,  
Professor,  
Govt. V.Y.T. P.G. College Durg
6. Dr. P.K. Singh,  
Assistant Professor,  
Govt. T.C.L. P.G. College Janjgir(C.G.)
7. DR. P.K. Agnihotri,  
Professor,  
Govt. Yuganandam Chhattisgarh College Raipur(C.G.)
8. Dr. B.D. Diwan,  
Professor,  
Govt. M.M.R. P.G. College Champa(C.G.)
9. Dr. Sandhya Patre,  
Assistant Professor,  
Sant Shiromani Guru Ravidas Govt. College Sargaon,  
Mungeli(C.G.)
10. Mrs. Mousami Lahare,  
Assistant Professor,  
Govt. G.N.A. P.G. College
11. Dr. Alka Shukla,  
Assistant Professor,  
Mohan Lal Jain(Mohan Bhaiya) Govt. College Khursipar,  
Bhilai(C.G.)
12. Dr. Arti Gupta,  
Professor, Govt. Dr. W.W.P. Girls P.G. College Durg (C.G.)
13. Dr. Deepti Tikariha,  
Assistant Professor, APSGMNS Govt. P.G. College  
Kawardha(C.G.)
14. Dr. Seema Negi,  
Assistant Professor, Govt. J.M.P. College, Takhatpur (C.G.)
15. Dr. Vikesh Kumar Jha,  
Assistant Professor, Govt. R.R.M. P.G. College Surajpur  
(C.G.)
16. Dr. Ashish Tiwari,  
Assistant Professor,  
Dr. Bhimrao Ambedkar Govt. College Pamgarh(C.G.)
17. Mr. Laxmi Chand Manwani,  
Assistant Professor,  
Government Vivekand PG College Manedragarh(C.G.)
18. Dr. K. Indira  
Professor,  
Government K. P. G. College Jagadapur (C.G.)

- Member

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Part A: Introduction			
Program: <b>Degree Course</b>		Class: <b>B.Sc. III Year</b>	Year: <b>2024</b>
		Session: <b>2024-2025</b>	
1.	Course Code	<b>CHEM-5T</b>	
2.	Course Title	Inorganic & Physical Chemistry	
3.	Course Type	Core Course	
4.	Pre-requisite (if any)	To Study this course our students must have had the diploma in chemistry or equivalent	
5.	Course Learning Outcomes (CLO)	<p>At the end of this course, the students will be able to learn the following aspects of Chemistry :</p> <ul style="list-style-type: none"> <li>• Metal-ligand bonding and stability of the metal complexes.</li> <li>• Spectroscopic and magnetic properties of transition metal complexes.</li> <li>• Fundamentals and catalytic and industrial applications of organometallic compounds.</li> <li>• Applications of bioinorganic chemistry, acid-base principles and inorganic polymers.</li> <li>• Fundamentals and applications of electromagnetic spectrum, microwave' infrared. Raman and electronic spectroscopy'</li> <li>• Basic concepts and theories of photochemistry and learn about the various aspects of its applications.</li> <li>• Problems and principles/concepts in electric, magnetic and optical properties of molecules.</li> </ul>	
6.	Credit Value	Theory: 4	
7.	Total Marks	<b>Max. Marks: 50</b>	<b>Min Passing Marks: 17</b>

Part B: Content of the Course		
Total No. of Lecturer (in hours per week):		Total Lecturer: <b>90</b>
Unit	Topics	No. of Lectures
I	<p><b>Metal- Ligand Bonding in Transition Metal Complexes</b>-Limitation of Crystal Field Theory, Tetragonal distortions from octahedral geometry, Jahn–Teller distortion, square planar geometry. Qualitative aspect of Ligand field and MO Theory, MO diagrams of representative coordination complexes of octahedral geometry.</p> <p><b>Thermodynamic and kinetic aspects of metal complexes.</b> A brief outline of thermodynamic stability of metal complexes and factors affecting the stability. Substitution reactions of square planar complexes. Trans-effect, theories of trans-effect. Mechanism of substitution reactions of Square planar complexes.</p>	15
II	<p><b>Magnetic Properties of Transition Metal Complexes:</b> Types of magnetic behavior, method of determining magnetic susceptibility by Gouy method, spin only formula, L-S coupling, correlation of <math>\mu_s</math> (spin only) and <math>\mu_{eff}</math>. Values, Orbital contribution to magnetic moments, Application of magnetic moment data for 3d metal complexes.</p> <p><b>Electronic spectra of Transition Metal Complexes:</b>Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectro-chemical series. Orgel-energy level diagram for <math>d^1</math> and <math>d^2</math> states,</p>	15

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	Discussion of the Electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex ion.	
III	<p><b>Organometallic chemistry:</b> Definition and classification of organometallic compounds based on nature of metal-carbon bond. Concept of hapticity of organic ligands. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. <math>\pi</math>-acceptor behavior of CO (MO diagram of CO to be discussed), Zeise's salt: Preparation and structure of 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 3dseries.</p> <p><b>Catalysis by Organometallic Compounds</b>—Study of the following industrial processes and their mechanism: Alkene hydrogenation (Wilkinson'sCatalyst), Polymerization of ethane (Ziegler–Natta Catalyst)</p>	15
IV	<p><b>Bioinorganic chemistry:</b> Classification of elements according to their action in biological system. Essential and trace elements in biological processes, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals, Metal ions present in biological systems, Toxicity of some metal ions (Hg, Pb, Cd and As), metalloporphyrins with special reference to hemoglobin and myoglobin and their structure and biological functions. Biological role of alkaline earth metals with special reference to <math>\text{Ca}^{2+}</math> and <math>\text{Mg}^{2+}</math>, nitrogen fixation.</p> <p><b>Inorganic polymers:</b> Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Silicates, phosphazenes and polyphosphate</p>	15
V	<p><b>Spectroscopy-I Introduction:</b> Characterization of Electromagnetic radiation, regions of the spectrum, interaction of radiation with matter, types of spectrums, types of spectroscopy studied in different regions of electromagnetic radiation. Born-Oppenheimer Approximation. Basic idea of instrumentation of simple photometer, atomic absorption and emission spectrophotometers.</p> <p><b>Photochemistry:</b> Difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Draper law, Lambert-Beer's law, Stark- Einstein law, quantum yield, examples of low and high quantum yields, Photochemical equilibrium and the differential rate of photochemical reactions, Quenching, Role of photochemical reaction in biochemical process. Jablonski diagram depicting various process occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), photosensitized reactions, energy transfer processes (simple examples), photostationary states, Chemiluminescence.</p> <p><b>Electronic Spectroscopy:</b> Basic principles, Electronic Spectra of diatomic molecule, Franck- Condon principle, types of electronic transition, application of electronic spectra.</p>	15
VI	<p><b>Spectroscopy-II Rotational Spectroscopy:</b> Rotational Spectrum of Diatomic molecules. Energy levels of a rigid rotor, selection rules, determination of bond length, qualitative description of non-rigid rotor, isotopic effect.</p> <p><b>Vibrational Spectroscopy:</b> Theory of IR Spectroscopy, vibrating diatomic molecule, energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, rotational-vibrational Spectra, determination of force constant, anharmonic oscillator</p> <p><b>Raman Spectroscopy:</b> Instrumentation of Raman spectrophotometer, Concept of polarizability, quantum theory of Raman spectra, stokes and</p>	15

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	antistokes lines, pure rotational and pure vibrational Raman spectra. selection rule, Applications of Raman Spectra.	
<b>Keywords:</b> Crystal field theory, transition metal complexes, magnetic properties, electronic spectra, organometallic compounds, carbonylation, inorganic polymers, electromagnetic radiations, photochemistry, rotational and vibrational spectroscopy, raman spectroscopy		

### Part C: Learning Resource

#### Text Books, Reference Books, Other Resources

#### Suggested Reading :

1. Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.
2. Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry Wiley-VCH, 1999.
3. Malik W.U. & et Al., Selected Topics in Inorganic Chemistry, S Chand Publication (2010).  
Puri, B.R. , Sharma, L.R., KaliaK.C. , Principles of Inorganic Chemistry, Vishal Publishing Co. (2021).
4. Gurtu, J.N., Gurtu, A., Advanced Physical Chemistry, Pragati Prakashan, Meerut, Edition IV, 2017
5. Dogra, S.K., Physical Chemistry through problems, Wiley Eastern.
6. Khera, H.C., Gurtu, J.N., Singh, J., Chemistry for B.Sc. Ist Year, Pragati Prakashan
7. Ball, D.W., Physical Chemistry, Thomson Press, India, 2007
8. Castellan, G.W., Physical Chemistry, 4th Edition, Narosa, 2004
9. Bariyar, A. & Goyal, S., B.Sc. Chemistry Combined (in Hindi), Krishna Educational Publishers Year 2019
10. Levine, I.N., Physical Chemistry, 6th Edition, Tata McGraw-Hill, 2010
11. Metz, C.R., 2000 Solved Problems in Chemistry, Sahaun Series, 2006
12. Puri, B.R., Pathania, M.S., Sharama, L.R., Principles of Physical Chemistry, Vishal Publishing Company 2020
13. Negi, A.S. & Anand, S.C., A Text Book of Physical Chemistry, 3rd Edition, New Age International Publication
14. Bajpai, D.N., Advanced Physical Chemistry, S. Chand, 2019
15. Bahal & Tuli, Essential of Physical Chemsitry, 2020
16. Greenwood, N.N. & Earnshaw A. Chemistry of the Elements, Butterworth-Heinemann, 1997.
17. Purcell, K.F & Kotz, J.C. Inorganic Chemistry W.B. Saunders Co, 1977.
18. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
19. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991
20. Atkins, P. W and Shriver D. N. Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).
21. Engel, T. and Reid, P., Physical Chemistry, 3rd Edition, Prentice Hall, 2012
22. Mortimer, R.G., Physical Chemistry, 3rd Edition, Elsevier, Noida, UP, 2009
23. Atkins' Physical Chemistry, 10th Edition, Oxford University Press, 2014
24. Barrow, G.M., Physical Chemistry Tata McGraw-Hill, 2007
25. Physical Chemistry, A Modern Introduction, 2nd Edition, William M. Davis, CRC Press, 2018.
26. Chemical Kinetics, Stochastic Processes and irreversible Thermodynamics, Santillan Moises, Springer, 2014.
27. Physical Chemistry, Madan R.L., McGraw Hill, 2021.
28. Physical Chemistry, 3rd Edition, Robert G. Mortimer, Elsevier, 2021.

#### E-learning resources:

- <http://heecontent.upsdc.gov.in/Home.aspx>
- <https://nptel.ac.in/courses/104/106/104106096/>
- <http://heecontent.upsdc.gov.in/Home.aspx>
- <https://nptel.ac.in/courses/104/106/104106096/>
- <https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm>
- <https://nptel.ac.in/courses/104/103/104103071/#>

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- <https://nptel.ac.in/courses>

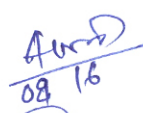

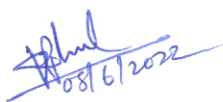




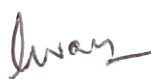

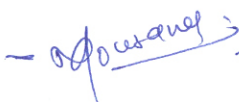
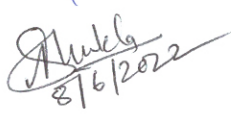
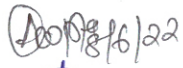
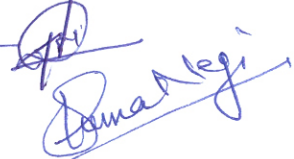
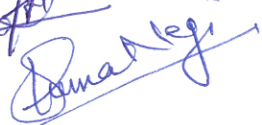

## Fundamental Chemistry related topics on SWAYAM platform and E-pathshala

### Part D: Assessment and Evaluation

Maximum Marks: 50

### DECLARATION

This is to certify that the syllabus is framed by the Central Board of Studies (Chemistry) as per the guidelines (TOR) of the Department of Higher Education, Raipur Chhattisgarh.

- |   |            |   |
|---|------------|---|
| 1. Dr. Alka Shrivastav,<br>Assistant Professor,<br>Govt. E.V.P.G. College, Korba                                      | - Chairman | <br>08/6       |
| 2. Smt. Priyanka Tiwari,<br>Assistant Professor,<br>Govt. J.P. Verma P.G. College, Bilaspur (C.G.)                    | - Member   |                |
| 3. Mr. Vijay Kumar Lahare,<br>Assistant Professor,<br>Govt. Lahiri P.G. College Chirimiri(C.G.)                       | - Member   | <br>08/6/2022  |
| 4. Dr. Rajmani Patel,<br>Assistant Professor,<br>Hemchand Yadav University, Durg (C.G.)                               | - Member   | <br>08.6.22    |
| 5. Dr. A.K. Singh,<br>Professor,<br>Govt. V.Y.T. P.G. College Durg (C.G.)   | - Member   |                |
| 6. Dr. P.K. Singh,<br>Assistant Professor,<br>Govt. T.C.L. P.G. College Janjgir(C.G.)                                 | - Member   |               |
| 7. Dr. P.K. Agnihotri,<br>Professor,<br>Govt. Yuganandam Chhattisgarh College Raipur(C.G.)                            | - Member   |              |
| 8. Dr. B.D. Diwan,<br>Professor,<br>Govt. M.M.R. P.G. College Champa(C.G.)  | - Member   |              |
| 9. Dr. Sandhya Patre,<br>Assistant Professor,<br>Sant Shiromani Guru Ravidas Govt. College Sargaon,<br>Mungeli(C.G.)  | - Member   |              |
| 10. Mrs. Mousami Lahare,<br>Assistant Professor,<br>Govt. G.N.A. P.G. College Bhatapara, (C.G.)                       | - Member   |              |
| 11. Dr. Alka Shukla,<br>Assistant Professor,<br>Mohan Lal Jain(Mohan Bhaiya) Govt. College Khursipar,<br>Bhilai(C.G.) | - Member   | <br>8/6/2022 |
| 12. Dr. Arti Gupta,<br>Professor, Govt. Dr. W.W.P. Girl's P.G. College Durg (C.G.)                                    | - Member   | <br>08/6/22  |
| 13. Dr. Deepti Tikariha,<br>Assistant Professor, APSGMNS Govt. P.G. College<br>Kawardha(C.G.)                         | - Member   |              |
| 14. Dr. Seema Negi,<br>Assistant Professor, Govt. J.M.P. College, Takhatpur (C.G.)                                    | - Member   |              |
| 15. Dr. Vikesh Kumar Jha,   | - Member   | <br>8/6/22   |



Assistant Professor, Govt. R.R.M. P.G. College Surajpur  
(C.G.)

16. Dr. Ashish Tiwari,  
Assistant Professor,  
Dr. Bhimrao Ambedkar Govt. College Pamgarh(C.G.)
17. Mr. Laxmi Chand Manwani,  
Assistant Professor,  
Government Vivekand PG College Manendragarh(C.G.)
18. Dr. K. Indira  
Professor,  
Government K. PG College Jagadapur (C.G.)

- Member

*Ashish Tiwari*  
8/6/22

- Member

*Laxmi Chand Manwani*  
8/6/22

- Member

*K. Indira*  
8-6-22

Part A: Introduction			
Program: Degree Course		Class: B.Sc. III Year	Year: 2024
		Session: 2024-2025	
1.	Course Code	CHEM-6T	
2.	Course Title	Organic & Physical Chemistry	
3.	Course Type	Core Course	
4.	Pre-requisite (if any)	To Study this course our students must have had the diploma in chemistry or equivalent	
5.	Course Learning Outcomes (CLO)	<p>At the end of this course, the students will be able to learn the following aspects of Chemistry</p> <ul style="list-style-type: none"> <li>Fundamental theoretical knowledge about the heterocyclic chemistry.</li> <li>Common organometallic reactions and draw reasonable reaction mechanisms.</li> <li>Various synthetic dyes and their structures.</li> <li>Chemical structure of proteins, amino acids and nucleic acids.</li> <li>5: To acquire knowledge about different mechanisms involved in polymerization, useful polymers and their structures.</li> <li>Basic principles of UV-Visible, IR and NMR spectra and their applications.</li> <li>Fundamentals/concepts/principles/postulates of quantum mechanics and need for development of quantum mechanics.</li> <li>Applications of quantum mechanics in the study of black body radiation, photoelectric effect, simple quantum mechanical models, bonding in molecules and molecular spectroscopy.</li> </ul>	
6.	Credit Value	Theory: 4	
7.	Total Marks	Max. Marks: 50	Min Passing Marks: 17

Part B: Content of the Course		
Total No. of Lecturer (in hours per week): 4		Total Lecturer: 90
Unit	Topics	No. of Lectures
I	<b>Heterocyclic Compounds</b> : Classification and Nomenclature of Heterocyclic Compounds, Five Membered Heterocyclic Compounds, Furan or Furfuran C <sub>4</sub> H <sub>4</sub> O, Pyrrole (C <sub>4</sub> H <sub>5</sub> N), Thiophene (C <sub>4</sub> H <sub>4</sub> S), 1,4 dicarbonyl compound, Six membered Heterocyclic Compounds Pyridine (C <sub>5</sub> H <sub>5</sub> N), Orientation in Pyridine and Substitution Reactions, Comparison of Basicity of Pyridine, Piperidine and Pyrrol, Condensed Five and Six Membered Heterocyclic, Indole (2,3 Benzopyrrole) C <sub>8</sub> H <sub>7</sub> N, Quinoline or α, β - Benzopyridine; (C <sub>9</sub> H <sub>7</sub> N), Isoquinoline (C <sub>9</sub> H <sub>7</sub> N).	15
II	<b>Carbohydrates</b> : Classification of Carbohydrates, Biological Importance of Carbohydrates, Monosaccharides, Relative and Absolute Configuration of Glucose and Fructose, Epimers and Anomers, Mutarotation, Determination of Ring size of Glucose and Fructose, Haworth Projections and Conformational Structure, Mutual Transformations or Inter Conversion among Monosaccharides, Disaccharides, Polysaccharides.	15

Ans

	<b>Biomolecules:</b> Amino acids, Proteins and Nucleic acids: Amino Acids, Isoelectric Point, Proteins, Difference between Globular Proteins and Fibrous Proteins, Peptide and Peptide Bond, Nucleic acid, structure and functions of RNA and DNA.	
III	<b>Infra-red and Ultraviolet –Visible Spectroscopy:</b> <b>Infra-red Spectroscopy:</b> Basics of Infra-red Spectroscopy, Fundamental vibrations and their symmetry, Instrumentation, Measurement of IR Spectra, Regions and Interpretation of IR Spectra of organic molecules and its applications. <b>Ultra-violet and Visible Spectroscopy:</b> Absorption Laws and Molar Absorptivity, Presentation of <i>UV</i> - Spectra of conjugated enes, UV Spectra of conjugated enones, applications of Ultra-violet spectroscopy. Effect of conjugation on $\lambda_{\text{max}}$ .	15
IV	<b>NMR and Mass Spectroscopy:</b> <b>NMR Spectroscopy:</b> Principle of NMR Spectroscopy, Instrumentation of NMR Spectroscopy, Nuclear Shielding and Deshielding, The Chemical Shift, Signal Splitting : Spin-Spin Coupling, Interpretation of PMR, Spectra, Structural Elucidation using UV, IR and NMR, Anisotropy and Anisotropic Effect, Coupling constant and signal resolution, $^{13}\text{C}$ -NMR Spectroscopy. <b>Mass Spectroscopy:</b> Principle of mass Spectroscopy, Instrumentation of mass Spectroscopy, fragmentation process. The $m/z$ value of the molecular ion to calculate the molecular formula. Isotope Effect.	15
V	<b>Quantum Mechanics-I :</b> Historical background of quantum mechanics, Black-body radiation, Planck's radiation law, photoelectric effect, Compton effect. Operator: Hamiltonian operator, angular momentum operator, Laplacian operator, postulate of quantum mechanics, eigen values, eigen function, Schrodinger time independent wave equation, physical significance of $\psi$ & $\psi^2$ , application of Schrodinger wave equation to particle in a one-dimensional box, hydrogen atom (separation into three equations) radial and angular wave functions.	15
VI	<b>Quantum Mechanics-II :</b> Quantum Mechanical approach of Molecular orbital theory, basic ideas-criteria for forming M.O. from A.O., LCAO approximation, formation of $\text{H}_2^+$ ion, calculation of energy levels from wave functions, bonding and antibonding wave functions, Concept of $\sigma$ , $\sigma^*$ , $\pi$ , $\pi^*$ orbitals and their characteristics, Hybrid orbitals- $sp$ , $sp^2$ , $sp^3$ Calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of $\text{H}_2$ , comparison of M.O. and V.B. models.	15

### Part C: Learning Resource

#### Suggested Readings :

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Puri, B.R., Pathania, M.S., Sharama, L.R., Principles of Physical Chemistry, Vishal Publishing Company 2020
5. Gurtu, J.N., Gurtu, A., Advanced Physical Chemistry, Pragati Prakashan, Meerut, Edition IV, 2017
6. Dogra, S.K., Physical Chemistry through problems, Wiley Eastern.

*Ans*



7. Khera, H.C., Gurtu, J.N., Singh, J., Chemistry for B.Sc. Ist Year, Pragati Prakashan
8. Ball, D.W., Physical Chemistry, Thomson Press, India, 2007
9. Castellan, G.W., Physical Chemistry, 4th Edition, Narosa, 2004
10. Bariyar, A. & Goyal, S., B.Sc. Chemistry Combined (in Hindi), Krishna Educational Publishers Year 2019
11. Levine, I.N., Physical Chemistry, 6th Edition, Tata McGraw-Hill, 2010
12. Metz, C.R., 2000 Solved Problems in Chemistry, Sahaun Series, 2006
13. Bahal & Tuli, Essential of Physical Chemsitry, 2020
14. Negi, A.S. & Anand, S.C., A Text Book of Physical Chemistry, 3rd Edition, New Age International Publication
15. Bajpai, D.N., Advanced Physical Chemistry, S. Chand, 2019
16. Engel, T. and Reid, P., Physical Chemistry, 3rd Edition, Prentice Hall, 2012
17. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994
18. Kalsi, P. S. Organic spectroscopy, New Age International, 2005.
19. Dyer, J.R., Introduction to spectroscopy, PHI
20. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
21. Mortimer, R.G., Physical Chemistry, 3rd Edition, Elsevier, Noida, UP, 2009
22. Atkins' Physical Chemistry, 10th Edition, Oxford University Press, 2014
23. Barrow, G.M., Physical Chemistry Tata McGraw-Hill, 2007

#### **E-learning resources:**

1. <http://heecontent.upsdc.gov.in/Home.aspx>
2. <https://nptel.ac.in/courses/104/106/104106096/>
3. <http://heecontent.upsdc.gov.in/Home.aspx>
4. <https://nptel.ac.in/courses/104/106/104106096/>
5. <https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm>
6. <https://nptel.ac.in/courses/104/103/104103071/#>
7. <https://nptel.ac.in/courses>

**Fundamental Chemistry related topics on SWAYAM platform and E-pathshala**

#### **Part D: Assessment and Evaluation**

Maximum Marks: 50

#### **DECLARATION**

This is to certify that the syllabus is framed by the Central Board of Studies (Chemistry) as per the guidelines (TOR) of the Department of Higher Education, Raipur Chhattisgarh.

1. Dr. Alka Shrivastav,  
Assistant Professor,  
Govt. E.V.P.G. College, Korba

- Chairman

*Alka*  
2/6.

2. Smt. Priyanka Tiwari,  
Assistant Professor,  
Govt. J.P. Verma P.G. College, Bilaspur (C.G.)

- Member

*Priyanka*

3. Mr. Vijay Kumar Lahare,  
Assistant Professor,  
Govt. Lahiri P.G. College Chirimiri(C.G.)







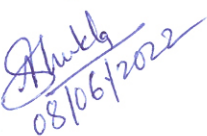
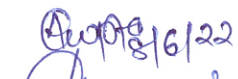
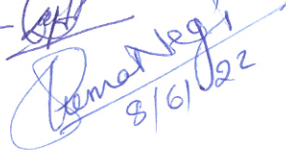

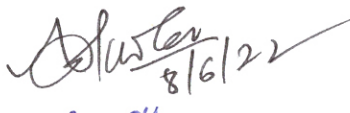

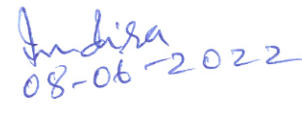
- Member

*Vijay*  
08/06/2022

4. Dr. Rajmani Patel,  
Assistant Professor,  
Hemchand Yadav University, Durg (C.G.)

- Member

*Rajmani*  
08.6.22

- |   |   |
|---|---|
| 5. Dr. A.K. Singh,<br>Professor,<br>Govt. V.Y.T. P.G. College Durg (C.G.)   | - Member  8/6/22        |
| 6. Dr. P.K. Singh,<br>Assistant Professor,<br>Govt. T.C.L. P.G. College Janjgir(C.G.)                                 | - Member               |
| 7. Dr. P.K. Agnihotri,<br>Professor,<br>Govt. Yuganandam Chhattisgarh College Raipur(C.G.)                            | - Member               |
| 8. Dr. B.D. Diwan,<br>Professor,<br>Govt. M.M.R. P.G. College Champa(C.G.)  | - Member               |
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| 16. Dr. Ashish Tiwari,<br>Assistant Professor,<br>Dr. Bhimrao Ambedkar Govt. College Pamgarh(C.G.)                    | - Member  8/6/22     |
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