DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM & MARKING SCHEME

B.Sc. III, IV, V, VI Semester

CHEMISTRY

(Based on Choice Based Credit System)

SESSION : 2024-25

ESTD : 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A+, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com

DEPARTMENT OF CHEMISTRY

Four Year Undergraduate Program

Semester III

Course Curriculum

B.Sc. CHEMISTRY

(DSC/GEC and DSE)

Session 2024-25

COURSE CURRICULUM

DEPARTMENT OF CHEMISTRY

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG (C.G.)

FYUP

B.Sc. (Chemistry) Semester III, IV, V & VI
(Based on NEP-2020)

Session 2024-25

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
Approved Curriculum for
B.Sc. CHEMISTRY by the members of Board of Studies for Session 2024-25
Scheme and Course Curriculum for B.Sc. Year 2 (Semester III & IV)

Scheme for B.Sc. Program with Chemistry - Second Year
(with 3 Subjects A, B*, C*Subject A-Chemistry)

Semester	Discipline Specific Course/ Core Course DSC (Credit-4)	Generic Elective Course GEC/ Discipline Specific Elective DSE (Credit-4)	Skill Enhancement Course SEC (Credit-2)	Ability Enhancement Course AEC (Credit-2)	Value Added Course VAC (Credit-2)	Total Credits
3	Subject A3: Chemistry 3 **Concepts in Chemistry - I** (Th=3, P=1) Subject B3 (Th=3, P=1) Subject C3 (Th=3, P=1)	Choose one from a pool of courses DSE A/B/C Or Choose one from a pool of courses GEC-3 (Th=3, P=1)	Choose 1 from pool of SEC (Th=1, P=1) Or Internship/ Apprenticeship /Project/ Community outreach (2)	EVS Theory (2)	Choose one from a pool of courses (2)	**22**
4	Subject A4: Chemistry 4 **Concepts in Chemistry - II** (Th=3, P=1) Subject B4 (Th=3, P=1) Subject C4 (Th=3, P=1)	Choose one from a pool of courses DSE-2 A/B/C Or Choose one from a pool of courses GEC-4 (Th=3, P=1) (Th=3, P=1)	Choose 1 from pool of SEC (Th=1, P=1) Or Internship/ Apprenticeship /Project/ Community outreach (2)	EVS Project (2)	Choose one from a pool of courses (2)	**22**
Students on exit shall be awarded undergraduate Diploma (in the Field of Multidisciplinary study) after securing the requisite 88 credits on completion of Semester IV **(Total Credits: Sem 1 - 22, Sem 2 – 22, Sem 3 – 22 and Sem 4 – 22; TOTAL - 88 credits)**						

***Subjects B/C:**
Maths/Physics/Botany/Zoology/Microbiology/Zoology/Geology/Biotechnology/Biochemistry/ Industrial Chemistry/Anthropology

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
Approved Curriculum for
B.Sc. CHEMISTRY by the members of Board of Studies for the Session 2024-25
Scheme and Course Curriculum for B.Sc. Year 2 (Semester III & IV)

Courses and Marking Scheme for Second-year B.Sc. with Chemistry

Year	Sem.	Course Code	Paper Title	Theory/ Practical	Credits	Marks	Sem End	IA
For Diploma								
Discipline Specific Courses – DSC (Core Courses)/Generic Elective Course - GEC								
2	III	BCHC 301	Concepts in Chemistry - I	Theory	3	100	80	20
		BCHL 301	Lab Course - 3	Practical	1	50		
	IV	BCHC 401	Concepts in Chemistry - II	Theory	3	100	80	20
		BCHL 401	Lab Course - 4	Practical	1	50		
2	**Skill Enhancement Courses - SEC**							
	III & IV	BCHS 01	Good lab practices in Chemistry	Theory	1	25		
				Practical/ Project	1	25		
		BCHS 02	Water remediation and conservation studies	Theory	1	25		
				Practical/ Project	1	25		
Discipline Specific Electives – DSE (Core Courses)								
2	III	BCHE 301	Basic Analytical Chemistry	Theory	3	100	80	20
		BCEL 301	Lab Course - 1	Practical	1	50		
	IV	BCHE 402	Environmental Chemistry	Theory	3	100	80	20
		BCEL 402	Lab Course -2	Practical	1	50		

Note: Semester End – 80% and Internal Assessment (IA) – 20% (Weightage of marks internal examinations will be included as per guidelines of Autonomous Examination Cell)
Minimum pass requirement : 40% in End Semester and IA separately.

DEPARTMENT OF CHEMISTRY
Session 2024-25
LIST OF COURSES OFFERED
(B.Sc. Year 2 – Semester III & IV)

For students opting B.Sc. with Chemistry

Discipline Specific Courses/Core Papers DSC (Credits: 04 each; T= Theory. P = Practical)

1. BCHC 301: Concepts in Chemistry - I (T- 3, P- 1); Practical: BCHL - 03
2. BCHC 401: Concepts in Chemistry - II (T- 3, P-1); Practical: BCHL - 04

Discipline Specific Elective DSE (Credits: 04 each; T= Theory. P = Practical)

1. BCHE 301: Basic Analytical Chemistry (T- 3, P- 1); Practical: BCEL- 01
2. BCHE 402: Environmental Chemistry (T- 3, P-1); Practical: BCEL- 02

Skill Enhancing Courses SEC (Credits:02)

1. BCHS 01: Good lab practices in Chemistry (T- 1, P- 1)
2. BCHS 02: Water remediation and conservation studies (T- 1, P- 1)

For students opting UG without Chemistry

Generic Electives Courses GEC (Credits: 04 each; T= Theory. P = Practical)

1. BCHC 301: Concepts in Chemistry - I (T- 3, P- 1); Practical: BCHL - 03
2. BCHC 401: Concepts in Chemistry - II (T- 3, P-1); Practical: BCHL - 04

The revised syllabus for B.Sc. (Chemistry) Semester III & IV is hereby approved for the Session 2024-25

Name & Signature of Members of Board of Studies

	Name	Signature
Chairperson /H.O.D	Dr. Anupama Asthana	
Subject Expert (University Nominee)	Dr. Arun Mishra	05/7/24
Subject Expert	Dr. S.C. Tiwari	
Subject Expert	Dr. Anju Jha	
Subject Expert		05/07/24
Representative (Industry)		
Representative (Alumni)	Dr. Bhawana Jain	
Representative (Professor Science Faculty Other Dept.)	Dr. S.D. Deshmukh	

Departmental members:	
1. Dr. V.S. Geete	
2. Dr. Sunitha B. Mathew	
3. Dr. A. Karlekar	
4. Srivastava (Upma Srivastava)	
5.	
6.	
7. Dr. A.C. Pillai	
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DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
Approved Curriculum for
B.Sc. CHEMISTRY by the members of Board of Studies for Session 2024-25
Scheme and Course Curriculum for B.Sc. Year 3 (Semester V & VI)

Scheme for B.Sc. Program with Chemistry - Third Year
(with 3 Subjects A, B*, C*Subject A-Chemistry)

Semester	Discipline Specific Course/ Core Course DSC (Credit-4)	Generic Elective Course GEC/ Discipline Specific Elective DSE (Credit-4)	Skill Enhancement Course SEC (Credit-2)	Ability Enhancement Course AEC (Credit-2)	Value Added Course VAC (Credit-2)	Total Credits
5	Subject A5: Chemistry 3 **Advanced Chemistry - I** (Th=3, P=1) Subject B5 (Th=3, P=1) Subject C5 (Th=3, P=1)	Choose two from a pool of courses DSE A/B/C Or Choose one from a pool of courses GE-5 & GE-6 (Th=3, P=1)	Choose 1 SEC (Th=1, P=1) Or Internship/ Apprenticeship/ Project/ Community outreach (2)	-	-	22
6	Subject A6: Chemistry 4 **Advanced Chemistry - II** (Th=3, P=1) Subject B6 (Th=3, P=1) Subject C6 (Th=3, P=1)	Choose two from a pool of courses DSE A/B/C Or Choose one from a pool of courses GE-7 & GE-8 (Th=3, P=1)	Internship/ Apprenticeship/ Project/ Community outreach (2)	-	-	22
Students on exit shall be awarded undergraduate Diploma (in the Field of Multidisciplinary study) after securing the requisite 132 credits on completion of Semester VI						

***Subjects B/C:**
Maths/Physics/Botany/Zoology/Microbiology/Zoology/Geology/Biotechnology/Biochemistry/ Industrial Chemistry/Anthropology

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
Approved Curriculum for
B.Sc. CHEMISTRY by the members of Board of Studies for the Session 2024-25
Scheme and Course Curriculum for B.Sc. Year 3 (Semester V & VI)

Courses and Marking Scheme for Third-year B.Sc. with Chemistry

Year	Sem.	Course Code	Paper Title	Theory/ Practical	Credits	Marks	Sem End	IA
For Diploma								
Discipline Specific Courses – DSC (Core Courses)/Generic Elective Course - GEC								
3	V	BCHC 501	Advanced Chemistry - I	Theory	3	75	60	15
		BCHL 501	Lab Course - 3	Practical	1	25		
	VI	BCHC 601	Advanced Chemistry - II	Theory	3	75	60	15
		BCHL 601	Lab Course - 4	Practical	1	25		
3	**Skill Enhancement Courses - SEC**							
		BCHS 01/02/03	Good lab practices in Chemistry/ Water remediation and conservation studies/ Green Chemistry	Theory	1	25	20	05
				Practical/ Project	1	25		
Discipline Specific Electives – DSE (Core Courses)								
3	V	BCHE 503	Dyes & Polymer Chemistry	Theory	3	75	60	15
		BCEL 503	Lab Course - 3	Practical	1	25		
	VI	BCHE 604	Instrumental Methods of Analysis	Theory	3	75	60	15
		BCEL 604	Lab Course - 4	Practical	1	25		

Note: Semester End – 80% and Internal Assessment (IA) – 20% (Weightage of marks internal examinations will be included as per guidelines of Autonomous Examination Cell)
Minimum pass requirement : 40% in End Semester and IA separately.

DEPARTMENT OF CHEMISTRY
Session 2024-25
LIST OF COURSES OFFERED
(B.Sc. Year 3 – Semester V & VI)

For students opting B.Sc. with Chemistry

Discipline Specific Courses/Core Papers DSC (Credits: 04 each; T= Theory. P = Practical)

1. BCHC 501: Advanced Chemistry - I (T- 3, P- 1); Practical: BCHL - 05
2. BCHC 601: Advanced Chemistry - II (T- 3, P-1); Practical: BCHL - 06

Discipline Specific Elective DSE (Credits: 04 each; T= Theory. P = Practical)

1. BCHE 503: Dyes & Polymer Chemistry (T- 3, P- 1); Practical: BCEL- 03
2. BCHE 604: Instrumental Methods of Analysis (T- 3, P-1); Practical: BCEL- 04

Skill Enhancing Courses SEC (Credits:02)

1. BCHS 01: Good lab practices in Chemistry (T- 1, P- 1)
2. BCHS 02: Water remediation and conservation studies (T- 1, P- 1)
3. BCHS 03: Green Chemistry (T- 1, P- 1)

For students opting UG without Chemistry

Generic Electives Courses GEC (Credits: 04 each; T= Theory. P = Practical)

1. BCHC 501: Advanced Chemistry - I (T- 3, P- 1); Practical: BCHL - 05
2. BCHC 601: Advanced Chemistry - II (T- 3, P-1); Practical: BCHL - 06

The revised syllabus for B.Sc. (Chemistry) Semester V & VI is hereby approved for the Session 2024-25

Name & Signature of Members of Board of Studies

	Name	Signature
Chairperson /H.O.D	Dr. Anupama Asthana	
Subject Expert (University Nominee)	Dr. Arun Mishra	05/7/24
Subject Expert	Dr. S.C. Tiwari	
Subject Expert	Dr. Hemlata Mohabey	
Subject Expert	Dr. Anju Jha	05/07/24
Representative (Industry)		
Representative (Alumni)	Dr. Bhawana Jain	
Representative (Professor Science Faculty Other Dept.)	Dr. S.D. Deshmukh	

Departmental members:		
1.	Dr. Y.S. Geete	
2.	Dr. Sunitha B. Mathew	
3.	Dr. A. Kaulgud	
4.		
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7.		Dr B.K. Pillai
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GOVT. V.Y.T. PG AUTONOMOUS COLLEGE. DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2024-25
CHEMISTRY

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **III**		Session: **2024-25**
1	Course Code	**BCHC 301**		
2	Course Title	**CONCEPTS IN CHEMISTRY - I**		
3	Course Type	**Discipline Specific Core (DSC)/ Generic Elective (GEC)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Explain the electronic configuration, characteristics and behaviour of transition elements and compare their properties. • CO2: Discuss the features, properties, similarities of lanthanide and actinide series elements. • CO3: Illustrate preparation and properties of alcohol, ethers and epoxides, explain structure, bonding and reactions of phenols. • CO4: Explain the structure, mechanism of nucleophilic addition reactions and interpret reactivity of carbonyls. • CO5: Discuss the laws of thermodynamics, determine the thermodynamic properties and apply concepts of thermochemistry.		
5	Credit Value	**3 Credit**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **100**		Minimum Passing Marks: **40**

PART B: CONTENT OF THE COURSE		
Total no. of Teaching/ Learning Periods = 45 Periods (45 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	**CHEMISTRY OF TRANSITION SERIES ELEMENTS** Transition Elements: Position in periodic table, electronic configuration, General characteristics, *viz.*, atomic and ionic radii, variable oxidation states, ability to form complexes, formation of coloured ions, magnetic and catalytic behaviour. General comparative treatment of 4d and 5d elements with their 3d analogues with respect to ionic radii, oxidation states and magnetic properties.	**9**
II	**CHEMISTRY OF LANTHANIDE & ACTINIDE ELEMENTS** Electronic configuration, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence, extraction and isolation of lanthanides, lanthanide compounds: oxides, hydroxides and halides. General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from uranium fuel rods, similarities between the latter actinides and the latter lanthanides.	**9**

III	**CHEMISTRY OF ALCOHOLS, ETHERS, EPOXIDES AND PHENOLS** **Alcohols:** Nomenclature, preparation by reduction, Grignard reagent and hydrolysis. Bouvaelt-Blanc reduction for the preparation of alcohols, relative reactivity of 1°, 2°, 3°alcohols and properties – esterification, acylation, SN1 and SN2, dehydration, oxidation. Dihydric alcohols – methods of formation, manufacture, chemical reactions of glycols - Oxidation by periodic acid and lead tetraacetate and pinacol-pinacolone rearrangement. Trihydric alcohols - Nomenclature, methods of formation, manufacture, synthesis, chemical reactions of glycerol, properties – reaction with oxalic acid and fermentation. **Ethers and Epoxides**: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$ **Phenols:** Structure and bonding in phenols, physical properties and acidic character, Comparative acidic strength of alcohols and phenols, acylation, carboxylation and oxidation. Mechanism of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesh, Lederer-Manasse, Reimer-Tiemann and coupling reaction.	9
IV	**CHEMISTRY OF CARBONYL COMPOUNDS** **Aldehydes and ketones:** Nomenclature, structure and reactivity of carbonyl group. General methods of preparation of aldehydes and ketones. **Mechanism of nucleophilic addition to carbonyl groups:** Benzoin, Aldol, Perkin and Knoevenagel condensation. Condensation with ammonia and its derivatives, Wittig reaction, Mannich reaction, Beckmann and Benzil- Benzilic rearrangement. Use of acetate as protecting group, Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen reduction, Wolf-Kishner reaction, $LiAlH_4$ and $NaBH_4$ reduction. Halogenation of enolizable ketones, An introduction to α, β-unsaturated aldehydes and ketones.	9
V	**THERMODYNAMICS-I** **Concepts in Thermodynamics:** Intensive and extensive variables; state and path functions; isolated, closed and open systems; Zeroth law of thermodynamics. First law: Concept of heat, work, internal energy and statement of first law; enthalpy, Relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases under isothermal and adiabatic conditions. Joule-Thomson expansion, inversion temperature of gases, expansion of ideal gases under isothermal and adiabatic condition. **Thermochemistry:** Laws of Thermochemistry, Heats of reactions, standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions, Adiabatic flame temperature, explosion temperature.	9

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Textbook Recommended :

Unified Textbook

Reference Books:

Inorganic Chemistry

1. Advanced Inorganic Chemistry, Satya Prakash.
2. Advanced Inorganic Chemistry, Agrawal & Agrawal.
3. Advanced Inorganic Chemistry, Puri & Sharma, S. Chand.
4. Inorganic Chemistry, Madan, S. Chand.

Organic Chemistry

1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2. Organic Chemistry, P.L. Soni.
3. Organic Chemistry, Bahl & Bahl.
4. Organic Chemistry, Joginder Singh.

Physical Chemistry

1. Physical Chemistry, Puri and Sharma, S. Chand.
2. Atkins, P. W. & Paula, J. Physical Chemistry 8th Ed., Oxford University Press(2006).
3. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
4. G. M. Barrow, Tata McGraw Hill (Fifth Edition) (2007)

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://soe.unipune.ac.in/studymaterial/ashwiniWadegaonkarSelf/421%20unit%204.pdf

https://www.ck12.org/chemistry/lanthanides-and-actinides/lesson/Lanthanides-and-Actinides-CHEM

https://archive.nptel.ac.in/content/storage2/courses/104103071/pdf/mod5.pdf

https://archive.nptel.ac.in/content/storage2/courses/104103071/pdf/mod6.pdf

https://onlinecourses.swayam2.ac.in/nou21_me01/preview

PART D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Comprehensive Evaluation (CCE):	**20 Marks**
Semester End Exam (SEE):	**80 Marks**

Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - 20 Marks and Assignment of 20 Marks

Semester End Exam (SEE)	Pattern - **FOUR Questions** - A, B, C, D Question A & B are compulsory, Section C and D will have internal choices. Question -A & B: Very short answer type (02 each) 04 x 5 = 20 Marks Question -C: Short answer type question 05 x 5 = 25 Marks Question -D: Long answer type question 07 x 5 = 35 Marks **Total = 80 Marks**

Name & Signature of Members of Board of Studies

Name	Signature
Chairperson /H.O.D	Dr. Anupama Asthana
Subject Expert (University Nominee)	Dr. Arun Mishra 05/7/24
Subject Expert	Dr. S.C. Tiwari
Subject Expert	H. Mohabey Dr. Hemlata Mohabey
Subject Expert	Dr. Anju Jha 05/07/24
Representative (Industry)	
Representative (Alumni)	Dr. Bhawana Jain B.Jain
Representative (Professor Science Faculty Other Dept.)	Dr. S. D. Deshmukh

Departmental members:	
1. Dr. V.S. Geele	
2. Dr. Sunitha B. Matheo	
3. Dr. A. Kashyap	
4. Divesh (Upma Srivastava)	
5.	
6.	
7.	Dr. A. U. P. Mau
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GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG

FOUR YEAR UNDERGRADUATE PROGRAM

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM 2024-25

CHEMISTRY LAB COURSE

Part A: INTRODUCTION				
Program: **FYUP**		Class: **B. Sc.** Semester - **III**		Session: **2024-25**
1	Course Code	**BCHL - 03**		
2	Course Title	**LAB COURSE -03**		
3	Course Type	**DSC/GEC**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Prepare standard solutions and determine the concentration of unknown solution by titration. • CO2: Identify unknown organic compounds by systematic qualitative analysis. • CO3: Determine physical property/ parameters such as solubility, heat of reaction, etc.		
5	Credit Value	**1 Credit**	**1 credit = 30 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **50**		Minimum Passing Marks: **20**

PART B: CONTENT OF THE COURSE	
S. No.	**List of Experiments**
I.	**INORGANIC CHEMISTRY**
	Volumetric analysis: Preparation of standard solutions of oxalic acid, potassium dichromate, EDTA, etc. and determine the concentration of unknown solution.
1.	Determination of acetic acid in commercial vinegar using NaOH.
2.	Estimation of ferrous & ferric by dichromate method.
3.	Estimation of hardness of water by EDTA.
4.	Determination of alkali content-antacid tablet using HCl.
5.	Estimation of calcium content in chalk as calcium oxalate by permanganometry.
6.	Estimation of copper using thiosulphate.
II.	**ORGANIC CHEMISTRY**
1.	Detection of elements (X, N, S).
2.	Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols, nitro, amine, amide, and carbonyl compounds, carbohydrates)
III.	**PHYSICAL CHEMISTRY**
1.	To determine the solubility of benzoic acid at different temperature and to determine ΔH of the dissolution process.
2.	To determine the enthalpy of neutralization of a weak acid/ weak base versus strong base/ strong acid and determine the enthalpy of ionization of the weak acid/ weak base.
3.	To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.
4.	To determine heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).

5.	To determine of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
Note:	Experiments may be added/ deleted subject to availability of time and facilities

PART C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Textbooks Recommended :

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012).
3. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).
4. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011). Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
5. Vogel, Practical Inorganic Chemistry

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://www.iul.ac.in/DWC/DeptNewsNotice/fileupload/Chemistry/_Chemistry-B.Sc.%20PCM%20II%20sem%20Lab%20Manuals.pdf

PART D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)

Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

Name	Signature
Chairperson /H.O.D	Dr. Anupama Asthana
Subject Expert (University Nominee)	Dr. Arun Mishra 05/7/24
Subject Expert	Dr. S.C. Tiwari
Subject Expert	Dr. Hemlata Mohabey H. Mohabey 05/07/2024
Subject Expert	(Dr. Anju Jha) 05/07/24
Representative (Industry)	
Representative (Alumni)	Dr. Bhawana Jain B. Jain
Representative (Professor Science Faculty Other Dept.)	Dr. S. D. Deshmukh

Departmental members:

1. Dr.V.S.Geete	
2. Dr. Sunitha B. Mathew	
3. Dr. A. Kerkeyar	
4. Upma Srivastava	
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GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2024-25
CHEMISTRY ELECTIVE

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **III**		Session: **2024-25**
1	Course Code	**BCHE 301**		
2	Course Title	**BASIC ANALYTICAL CHEMISTRY**		
3	Course Type	**Discipline Specific Elective (DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Determine errors in analysis and compare significance of data. • CO2: Discuss the sampling techniques for diverse samples. • CO3: Explain the various aspects and methods of analysis. • CO4: Prepare standard solutions and apply the principle of volumetric analysis. • CO5: Illustrate the principle and application of gravimetric analysis.		
5	Credit Value	**3 Credit**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **100**		Minimum Passing Marks: **40**

PART B: CONTENT OF THE COURSE

Total no. of Teaching/ Learning Periods = 45 Periods (45 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Periods
I	Errors in chemical analysis. Types of errors: Systematic and random, Absolute and relative, Additive and proportional. Normal distribution of indeterminate errors. Statistical parameters for data evaluation: Mean, median, average deviation, standard deviation, coefficient of variation, relative standard deviation. Accuracy and precision of results. Comparison of data using F and t-test, rejection of data using Q test. Numerical problems.	9
II	Sampling and sample treatment Criteria for representative sample. Bulk, gross, incremental and analysis sample. Sampling statistics. Techniques of sampling of ambient air, water and soil samples. Methods of sample size reduction: Coning and quartering, rolling and quartering. Hazards in sampling. Sample dissolution methods for elemental analysis: Dry and wet ashing, acid digestion, fusion processes and dissolution of organic samples.	9
III	Types of analysis: Macro, semi-micro, micro, sub-micro and ultra-micro. Major, minor and trace constituents of a sample. Qualitative and quantitative aspects of analysis Classification of analytical Techniques, Qualitative and quantitative analysis. Classical and instrumental methods. Factors affecting choice of analytical method.	9
IV	Volumetric analysis General principle. Criteria for reactions used in titrimetric analysis. Primary standards and secondary standards. Concepts of equivalent weight and molecular weight, normality, molarity and various methods of expressing concentrations. Internal and external indicators. Theories of indicators in acid-base, precipitation, redox and complexometric titrations. Calculations involving preparation of standard solutions. Stoichiometric calculations in various types of titrations.	9
V	Gravimetric analysis General principles and conditions of precipitation. Concepts of solubility, solubility product and precipitation equilibria. Numerical problems based on solubility and solubility product. Purity of precipitate: Co-precipitation and post-precipitation. Supersaturation and peptization. Criteria of selection of wash liquids. Steps involved in gravimetric analysis of barium as barium sulphate.	9

Part C: LEARNING RESOURCE	
Text Books, Reference Books, Other Resources	
Text Books/ Reference Books: 1. Vogel's Text book of quantitative analysis. 2. O.P. Pandey, D.N. Bajpai, S. Giri, Practical Chemistry, S. Chand Publications 3. B.B.L.Shrivastava, Amarnath Mishra, Fundamentals of analytical chemistry 4. Daniel C Harris, Quantitative chemical analysis. 5. Gary D. Chrstian, Purnendu K. Dasgupta, Kevin A. Schug, analytical Chemistry, John Wiley **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** https://www.slideshare.net/slideshow/errors-in-chemical-analysis-and-sampling/76813858 https://onlinecourses.nptel.ac.in/noc22_cy61/preview	
PART D: ASSESSMENT AND EVALUATION	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **100 Marks** **Continuous Comprehensive Evaluation (CCE):** **20 Marks** **Semester End Exam (SEE):** **80 Marks**	
Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - 20 Marks and Assignment of 20 Marks
Semester End Exam (SEE)	Pattern - **FOUR Questions** - A, B, C, D Question A & B are compulsory, Section C and D will have internal choices. Question -A & B: Very short answer type (02 each) 04 x 5 = 20 Marks Question -C: Short answer type question 05 x 5 = 25 Marks Question -D: Long answer type question 07 x 5 = 35 Marks **Total = 80 Marks**

Name & Signature of Members of Board of Studies

Name	Signature	Departmental members:	
Chairperson /H.O.D	Dr. Anupama Asthana	1.	Dr. V.S. Geete
Subject Expert (University Nominee)	Dr. Arun Mishra 05/7/24	2.	Dr. Sunitha B. Mathew
Subject Expert	Dr. S.C. Tiwari	3.	Dr. A. Kashyap
Subject Expert	H. Mohabey Dr. Hemlata Mohabey	4.	Divasha Upma Shrivastava
Subject Expert	(Dr. Anju Jha) 05/07/24	5.	
Representative (Industry)		6.	
Representative (Alumni)	Dr. Bhawana Jain	7.	Dr. N. K. Pillai
Representative (Professor Science Faculty Other Dept.)	B. Jain	8.	
		9.	
		10.	

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG

FOUR YEAR UNDERGRADUATE PROGRAM

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM 2024-25

CHEMISTRY ELECTIVE LAB COURSE

Part A: INTRODUCTION				
Program: **FYUP**		Class: **B. Sc.** Semester - **III**		Session: **2024-25**
1	Course Code	**BCEL - 01**		
2	Course Title	**LAB COURSE ELECTIVE - 01**		
3	Course Type	**DSE**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Prepare standard solutions and determine the concentration of unknown solution by titration. • CO2: Identify unknown organic compounds by systematic qualitative analysis. • CO3: Determine physical property/ parameters such as solubility, heat of reaction, etc.		
5	Credit Value	**1 Credit**	**1 credit = 30 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **50**		Minimum Passing Marks: **20**

PART B: CONTENT OF THE COURSE	
S. No.	**List of Experiments**
	Lab Work/Demonstration/Tutorial
1.	Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture by volumetric titration.
2.	Estimation of oxalic acid by titrating it with potassium permagnate by volumetric titration.
3.	Estimation of water of crystallization in Mohr's salt by titrating with potassium permagnate.
4.	Estimation of Fe (II) ions by titrating it with potassium dichromate using internal indicator.
5.	Estimation of Cu (II) ions iodometrically using Hypo.
6.	Determination of heat capacity of calorimeter for different volumes.
7.	Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
8.	Determination of ionization of acetic acid.
9.	Determination of solubility of benzoic acid in water and determination of enthalpy of solublization.
10.	Analysis of soil (a)Determination of pH of soil. (b)Determination of total soluble salts. (c)Determination of carbonate and bicarbonate. (d)Determination of calcium, magnesium and iron.
Note	Experiments may be added/ deleted subject to availability of time and facilities

PART C: LEARNING RESOURCE
Text Books, Reference Books, Other Resources
Textbooks Recommended : 1. Vogel's Text book of quantitative analysis. 2. O.P. Pandey, D.N. Bajpai, S. Giri, Practical Chemistry, S. Chand Publications 3. B.B.L.Shrivastava, Amarnath Mishra, Fundamentals of analytical chemistry 4. Daniel C Harris, Quantitative chemical analysis. 5. Gary D. Chrstian, Purnendu K. Dasgupta, Kevin A. Schug, analytical Chemistry, John Wiley **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** https://nptel.ac.in/ https://epathshala.nic.in/ https://swayam.gov.in/

PART D: ASSESSMENT AND EVALUATION	
Suggested Continuous Evaluation Methods: **Maximum Marks: 50 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

	Name	Signature
Chairperson /H.O.D	Dr. Anupama Asthana	
Subject Expert (University Nominee)	Dr. Arun Mishra	05/7/24
Subject Expert	Dr. S.C. Tiwari	
Subject Expert	Dr. Hemlata Mohabey	
Subject Expert	Dr. Anju Jha	
Representative (Industry)		
Representative (Alumni)	Dr. Bhawana Jain	
Representative (Professor Science Faculty Other Dept.)	Dr. S. D. Deshmukh	

Departmental members:		
1.	Dr. V.S. Geete	
2.	Dr. Sunitha B. Mathew	
3.	Dr. A. Kashyap	
4.	Srivastava (Upma Srivastava)	
5.		
6.		
7.		Dr. A.K. Pillai
8.		
9.		
10.		

DEPARTMENT OF CHEMISTRY

Four Year Undergraduate Program

Semester IV

Course Curriculum

B.Sc. CHEMISTRY

(DSC/GEC and DSE)

Session 2024-25

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG

FOUR YEAR UNDERGRADUATE PROGRAM

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM 2024-25

CHEMISTRY

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **IV**		Session: **2024-25**
1	Course Code	**BCHC 401**		
2	Course Title	**CONCEPTS IN CHEMISTRY - II**		
3	Course Type	**Discipline Specific Core (DSC)/ Generic Elective (GEC)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • **CO1:** Name coordination compounds and explain isomerization and stereochemistry of complexes, discuss VBT and CFT. • **CO2:** Explain concepts and theories of acids and bases, HSAB, non-aqueous solvents. • **CO3:** Discuss the structure, bonding, mechanism, properties and preparation of carboxylic acid, carboxylic acid derivative, synthesis and properties of ethyl acetoacetate. • **CO4:** To have a firm foundation of thermodynamics and its applications, explain first and second laws, thermodynamic properties and calculate various thermodynamic functions. • **CO5:** To explain criteria of thermodynamic equilibrium, concept of fugacity, thermodynamic derivation of relations between the various equilibrium constants, and apply concept of ionic equilibria, salt hydrolysis and buffer solution.		
5	Credit Value	**3 Credit**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks:**100**		Minimum Passing Marks: **40**

PART B: CONTENT OF THE COURSE		
Total no. of Teaching/ Learning Periods = 45 Periods (45 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	**COORDINATION CHEMISTRY** **Coordination compounds:** Werner's theory and its experimental verification, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelates, polynuclear complexes. **Valence bond theory & Crystal field theory:** VBT (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal Field Theory, Crystal field splitting and stabilization energy, measurement of 10 Dq (Δo), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq (Δo, Δt). Octahedral vs. tetrahedral coordination.	**9**

II	**ACIDS-BASES AND NON-AQUEOUS SOLVENTS** **Concepts of acids and bases:** Arrhenius, Bronsted-Lowry, conjugate acids and bases, relative strengths of acids and bases and Lewis concepts of acids and bases. **Hard and soft acids and bases (HSAB):** Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, Applications of HSAB principle. **Non-aqueous solvents:** Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid ammonia.	9
III	**CARBOXYLIC ACIDS AND DERIVATIVES** **Carboxylic acids:** Preparation, Structure and bonding, Physical and chemical properties including, acidity of carboxylic acids, effects of substituents on acid strength, Hell-Volhard Zeilinsky reaction. Reduction of carboxylic groups, Mechanism of decarboxylation. Di carboxylic acids: Methods of formation and effect of heat and dehydrating agents, Hydroxyacids. **Carboxylic acid derivatives:** Structure of acid chlorides, esters, amides and acid anhydrides, Relative stability of acyl derivatives. Physical properties, inter-conversion of acid derivatives by nucleophilic acyl substitution. Mechanism of acid and base catalyzed esterification and hydrolysis. **Organo-synthesis via enolates:** Active methylene group, alkylation of diethylmalonate and ethyl acetoacetate, Synthesis of ethyl acetoacetate: The Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Robbinson annulations reaction.	9
IV	**THERMODYNAMICS-II** **Second Law of Thermodynamics:** Spontaneous process, Second law, Statement of Carnot cycle and efficiency of heat engine, Carnot's theorem, thermodynamic state of temperature. **Concept of entropy:** Entropy change in a reversible and irreversible process, entropy change in isothermal reversible expansion of an ideal gas, entropy change in isothermal mixing of ideal gases, physical signification of entropy, Molecular and statistical interpretation of entropy. **Gibbs and Helmholtz free energy:** G and A, variation of G and A with pressure, volume, temperature, Gibbs-Helmholtz equation, Maxwell relations. **Third Law of Thermodynamics:** Nernst Heat Theorem, Elementary idea of Third law of Thermodynamics, concept of residual entropy, calculation of absolute entropy of molecule.	9

V	**CHEMICAL EQUILIBRIA AND IONIC EQUILIBRIA** **Chemical equilibrium:** Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases. Concept of Fugacity, Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exergonic and endergonic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Thermodynamic derivation of relations between the various equilibrium constants Kp, Kc and Kx. Le Chatelier principle (quantitative treatment). Equilibrium between ideal gas and a pure condensed phase. **Ionic equilibrium:** Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono protic acids (exact treatment). Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.	9

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Textbook Recommended :

Unified Textbook

Reference Books:

Inorganic Chemistry

1. Advanced Inorganic Chemistry, Satya Prakash.
2. Advanced Inorganic Chemistry, Agrawal & Agrawal.
3. Advanced Inorganic Chemistry, Puri & Sharma, S. Chand.
4. Inorganic Chemistry, Madan, S. Chand.

Organic Chemistry

1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2. Organic Chemistry, P.L. Soni.
3. Organic Chemistry, Bahl & Bahl.
4. Organic Chemistry, Joginder Singh.

Physical Chemistry

1. Physical Chemistry, Puri and Sharma, S. Chand.
2. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press(2006).
3. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
4. G. M. Barrow, Tata McGraw Hill (Fifth Edition) (2007)

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://nptel.ac.in/courses/104105033

https://archive.nptel.ac.in/content/syllabus_pdf/104103069.pdf

https://onlinecourses.nptel.ac.in/noc22_cy46/preview

https://archive.nptel.ac.in/courses/104/106/104106089/

PART D: ASSESSMENT AND EVALUATION	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **100 Marks** **Continuous Comprehensive Evaluation (CCE):** **20 Marks** **Semester End Exam (SEE):** **80 Marks**	
Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - 20 Marks and Assignment of 20 Marks
Semester End Exam (SEE)	Pattern - **FOUR Questions** - A, B, C, D Question A & B are compulsory, Section C and D will have internal choices. Question -A & B: Very short answer type (02 each) 04 x 5 = 20 Marks Question -C: Short answer type question 05 x 5 = 25 Marks Question -D: Long answer type question 07 x 5 = 35 Marks **Total = 80 Marks**

Name & Signature of Members of Board of Studies

	Name	Signature
Chairperson /H.O.D	Dr. Anupama Asthana	
Subject Expert (University Nominee)	Dr. Arun Mishra	05/7/24
Subject Expert	Dr. S.C. Tiwari	
Subject Expert	H. Mohabey Dr. Hemlata Mohabey	
Subject Expert		05/07/24
Representative (Industry)		
Representative (Alumni)	Dr. Bhawana Jain	B. Jain
Representative (Professor Science Faculty Other Dept.)	Dr. S. D. Deshmukh	

Departmental members:

1. Dr. V. S. Geete
2. Dr. Sunitha B. Mathew
3. Dr. A. Kashyap
4. Dr. Uma Srivastava
5. .....
6. .....
7. Dr. A. K. Pillai
8. .....
9. .....
10. .....

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG

FOUR YEAR UNDERGRADUATE PROGRAM

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM 2024-25

CHEMISTRY LAB COURSE

Part A: INTRODUCTION				
Program: **FYUP**		Class: **B. Sc.** Semester - **IV**		Session: **2024-25**
1	Course Code	**BCHL - 04**		
2	Course Title	**LAB COURSE -04**		
3	Course Type	**DSC/GEC**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Apply the various aspects of qualitative analysis in inorganic mixture and identify radicals including interfering radicals. • CO2: Separate components of mixture by paper chromatography, prepare simple organic compounds. • CO3: Perform experiments based on physical aspects and calculate parameters.		
5	Credit Value	**1 Credit**	**1 credit = 30 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **50**		Minimum Passing Marks: **20**

PART B: CONTENT OF THE COURSE	
S. No.	**List of Experiments**
I.	**INORGANIC CHEMISTRY** Qualitative semimicro analysis of mixtures containing 5 radicals. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested: CO_3^{2-}, NO^{2-}, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, CH_3COO^-, F^-, Cl^-, Br^-, I^-, NO_3^-, BO_3^{3-}, $C_2O_4^{2-}$, PO_4^{3-}, NH_4^+, K^+, Pb^{2+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}. Mixtures should preferably contain one interfering anion, or insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) or combination of anions e.g. CO_3^{2-} and SO_3^{2-}, NO_2^- and NO_3^-, Cl^-, Br^-, and I^-.
II.	**ORGANIC CHEMISTRY** Preparation of Organic Compounds: (i) m-dinitrobenzene, (ii) Acetanilide, (iii) Bromo/Nitro-acetanilide (iv) Oxidation of primary alcohols-Benzoic acid from benzyl alcohol, (v) azo dye.
III.	**CHROMATOGRAPHY** Principles involved in chromatographic separations. Paper chromatographic separation of following: i. Ni (II) and Co (II) ii. Fe (III) and Al (III) iii. Pb (II) and Ag (I) iv. Dye mixture
IV.	**PHYSICAL CHEMISTRY**
1.	Determination of the transition temperature of the given substance by thermometric/ dialometric method (e.g. $MnCl_2.4H_2O/SrBr_2.2H2O$).
2.	Determination of molecular weight by Rast Camphor and Landsberger method.
3.	Distribution of acetic/ benzoic acid between water and cyclohexane.
4.	Study the equilibrium of at least one of the following reactions by the distribution method: (i) $I_2(aq.) + I^- \rightarrow I_3^-(aq.)$ (ii) $Cu^{2+}(aq.) + nNH_3 \rightarrow Cu(NH_3)_n$
Note:	Experiments may be added/ deleted subject to availability of time and facilities

PART C: LEARNING RESOURCE	
Text Books, Reference Books, Other Resources	
Textbooks Recommended : 1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009) 2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012). 3. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000). 4. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011). Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003). 5. Vogel, Practical Inorganic Chemistry	
Online Resources: (e- Resources/ e- Books/ e- Learning Portals) https://www.iul.ac.in/DWC/DeptNewsNotice/fileupload/Chemistry/_Chemistry-B.Sc.%20PCM%20II%20sem%20Lab%20Manuals.pdf	
PART D: ASSESSMENT AND EVALUATION	
Suggested Continuous Evaluation Methods: **Maximum Marks: 50 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

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Subject Expert (University Nominee)	Dr. Arun Mishra	05/7/24
Subject Expert	Dr. S.C. Tiwari	
Subject Expert	Dr. Hemlata Mohabey	
Subject Expert	Dr. Anju Jha.	
Representative (Industry)		
Representative (Alumni)	Dr. Bhawana Jain	B. Jain
Representative (Professor Science Faculty Other Dept.)	Dr. S. D. Deshmukh	

Departmental members:		
1.	Dr. V.S. Geete	
2.	Dr. Sunitha B. Matheo	
3.	Dr. A. Kashyap	
4.	Avasta Upma Shivastava	
5.		
6.		
7.	Dr. A.K. Pillai	
8.		
9.		
10.		

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2024-25
CHEMISTRY ELECTIVE

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **IV**		Session: **2024-25**
1	Course Code	**BCHE 301**		
2	Course Title	**ENVIRONMENT CHEMISTRY**		
3	Course Type	**Discipline Specific Elective (DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • **CO1:** Describe the composition of various environmental components and discuss about biogeochemical cycles. • **CO2:** Explain hydrological cycle; understand sources, consequences of water pollution and its management process. • **CO3:** Describe the chemical composition of atmosphere, atmospheric chemical phenomena and air pollution. • **CO4:** Explain composition, types and properties of soil. • **CO5:** Discuss the sources of radiation/soil pollution and solid waste treatment and management.		
5	Credit Value	**3 Credit**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **100**		Minimum Passing Marks: **40**

PART B: CONTENT OF THE COURSE

Total no. of Teaching/ Learning Periods = 45 Periods (45 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Periods
I	**INTRODUCTION TO ENVIRONMENT** Biosphere, Lithosphere, Hydrosphere and Atmosphere, Ecological principles-aspects of ecology, classification, types of ecosystems. Biogeochemical cycles-carbon, nitrogen, phosphorous, oxygen, hydrogen. Thermal pollution: sources, harmful effects, and prevention of thermal pollution. Noise pollution: sources, effects, and control of noise pollution.	9
II	**WATER** Origin, physico-chemical properties of water, sources of water, hydrological cycle, criteria of water quality, Water management - water shed management, rainwater harvesting, water pollution - sources, consequences and harmful effects of water pollution, strategies for water pollution control.	9
III	**AIR** Major regions of the atmosphere, composition of the atmosphere, temperature inversion and air pollution episodes, photochemistry of the atmosphere, depletion of the stratospheric ozone, greenhouse effect, greenhouse gases, remedial measures for reversion of greenhouse effect, acid rain, photochemical smog, particulate matter.	9
IV	**SOIL** Chemical and mineralogical composition of soil, classification of soil, types of soil-saline and alkaline, physical properties – texture, bulk density, permeability, chemical properties—Ion exchange capacity, soil pH and micro and macro nutrient availability.	9

V	**RADIATION POLLUTION AND SOLID WASTE TREATMENT** Introduction to radiation chemistry, sources of radioactive pollution, effects of radioactive pollution, protection from radiation, control of radiation. Soil pollution, Soil pollution management; nuclear waste management; sewage treatment; solid waste management.	9

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1. De. A. K., Environmental Chemistry, New Age International, 1990.
2. Miller T. G. Jr., Environmental Science, Wadsworth publishing House, Meerut.
3. S. E. Manahan, Environmental Chemistry, 1993, Boca Raton, Lewis publisher
4. Sharma and Kaur, Environmental Chemistry, 2016, Krishna publishers
5. Khopkar, S.M., Environmental Pollution, Monitoring and Control, 2007, New Age International.
6. Sodhi G. S., Fundamental Concepts of Environmental Chemistry (Third Edition) Narosa (2009).
7. Skoog D. A., Principles of instrumental analysis: Fifth Edition, Sauns College Publishing (London).
8. Bockris, J. O. M., Environmental chemistry. Academic Press (1977).
9. Kudesia, V. P., Water pollution. Pragati Prakashan. (1985).
10. Lodge, J. P. Methods of air sampling and analysis. Publications, Jaipur (1994).
11. Dara, S. S. Environmental chemistry. New Delhi: S Chand & Company Ltd. (2002).
12. Mahajan, Environmental chemistry. New Delhi: S Chand & Company Ltd. (2010).

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://archive.nptel.ac.in/courses/122/106/122106030/

https://scienceinfo.com/environmental-chemistry-definition-importance-application-and-careers/

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_-_The_Central_Science_(Brown_et_al.)/18%3A_Chemistry_of_the_Environment

https://www.ncbi.nlm.nih.gov/books/NBK83730/

https://ebooks.inflibnet.ac.in/esp16/chapter/water-pollution/#:~:text=The%20amount%20of%20dissolved%20oxygen,dissolved%20oxygen%20than%20saline%20water

PART D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Comprehensive Evaluation (CCE):	**20 Marks**
Semester End Exam (SEE):	**80 Marks**

Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - 20 Marks and Assignment of 20 Marks

Semester End Exam (SEE)	Pattern - **FOUR Questions** - A, B, C, D Question A & B are compulsory, Section C and D will have internal choices. Question -A & B: Very short answer type (02 each) 04 x 5 = 20 Marks Question -C: Short answer type question 05 x 5 = 25 Marks Question -D: Long answer type question 07 x 5 = 35 Marks **Total = 80 Marks**

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Subject Expert	Dr. S.C. Tiwari	
Subject Expert	Dr. Hemlata Mahobey	
Subject Expert	H. Mahobey	
Representative (Industry)	Dr. Anju Jha (Subject Expert)	
Representative (Alumni)	Dr. Bhawana Jain	
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Departmental members:		
1.	Dr. V.S Geeta	
2.	Dr. Sunitha B. Mathew	
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GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG

FOUR YEAR UNDERGRADUATE PROGRAM

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM 2024-25

CHEMISTRY LAB COURSE

Part A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **IV**		Session: **2024-25**
1	Course Code	**BCEL - 02**		
2	Course Title	**LAB COURSE ELECTIVE - 02**		
3	Course Type	**DSE**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Prepare standard solutions and determine the concentration of unknown solution by titration. • CO2: Identify unknown organic compounds by systematic qualitative analysis. • CO3: Determine physical property/ parameters such as solubility, heat of reaction, etc.		
5	Credit Value	**1 Credit**	**1 credit = 30 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **50**		Minimum Passing Marks: **20**

PART B: CONTENT OF THE COURSE	
S. No.	**List of Experiments**
	Determination of following parameters in water and soil:
1.	**Water Analysis:** Determination of - a. Alkalinity b. Acidity c. Temporary, Permanent and total hardness d. Sulphate e. Phosphorus
2.	**Water Analysis:** Determination of - a. Nitrites b. Chlorides c. D.O, BOD and COD d. Insecticides e. Pesticides e. Analysis of chemicals used in water and waste water treatment-Alum, bleaching powder, activated carbon. f. chlorine content in tap water, storage tank and swimming pool and its comparison.
3.	Soil Analysis: Determination of: a) pH b) Conductivity c) Ca d) Mg e) Heavy metals like Cr, Pb, Cd, Zn.

4.	Miscellaneous • Analysis of nutrients – Nitrogen (total, ammonia, nitrite, and nitrate), Phosphate • Determination of N, P, K of soil • Determination of macro and micro nutrients in soil. • Sampling of water- tap water, well water, overhead storage tank water, pond and lake water. • Physicochemical and organoleptic characteristics of the above water samples. • Statistical evaluation of the data obtained for optimization of results. • Determination of Total, Total dissolved and total suspended solids and its significance. • Determination of noise pollution in a particular area with noise dosimeter. • Study of particulate matter. • Study of atmospheric chemistry. • Air Monitoring • Gas detection.
Note:	Experiments may be added/ deleted subject to availability of time and facilities

PART C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Textbooks Recommended :

1. Vogel, A. I. (1955). A text-book of quantitative inorganic analysis: theory and practice. Longmans, Green and Company.
2. Sandell, E. B. (1945). Colorimetric determination of traces of metals (Vol. 59, No. 6, p. 481). LWW.
3. Moore, J. W., & Ramamoorthy, S. (2012). Heavy metals in natural waters: applied monitoring and impact assessment. Springer Science & Business Media.
4. Lenihan, J., & Fletcher, W. W. (Eds.). (1977). The chemical environment (p. 163pp).
5. Boubel, R. W., Vallero, D., Fox, D. L., Turner, B., & Stern, A. C. (2013). Fundamentals of air pollution. Elsevier.
6. Clesceri, L. S. (1998). Standard methods for examination of water and wastewater. American public health association, 9.
7. Rump, H. H. (1999). Laboratory manual for the examination of water, waste water and soil (No. Ed. 3). Wiley-VCH Verlag GmbH.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://ncert.nic.in/textbook/pdf/kech207.pdf

https://archive.nptel.ac.in/courses/122/106/122106030/

https://scienceinfo.com/environmental-chemistry-definition-importance-application-and-careers/

https://www.ncbi.nlm.nih.gov/books/NBK83730/

https://ebooks.inflibnet.ac.in/esp16/chapter/water pollution/#:~:text=The%20amount%20of%20dissolved%20oxygen,dissolved%20oxygen%20than%20saline%20water.

https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_The_Central_Science_(Brown_et_al.)/18%3A_Chemistry_of_the_Environment

https://byjus.com/chemistry/environmental-chemistry/

PART D: ASSESSMENT AND EVALUATION	
Suggested Continuous Evaluation Methods: **Maximum Marks: 50 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

	Name	Signature
Chairperson /H.O.D	Dr. Anupama Asthana	
Subject Expert (University Nominee)	Dr. Arun Mishra	05/7/24
Subject Expert	Dr. S.C. Tiwari	
Subject Expert	H. Mohabey (Dr. Hemlata Mohabey)	
Subject Expert	(Dr. Anju Jha)	
Representative (Industry)		
Representative (Alumni)	Dr. Bhawana Jain B.Jain	
Representative (Professor Science Faculty Other Dept.)	Dr. S.D. Deshmukh	

Departmental members:	
1. Dr. V.S. Geete	
2. 05.07.24 Dr. Sunitha B. Mathew	
3. Dr. A. Kashyap	
4. Vastav Uma Srivastava	
5.	
6.	
7.	Dr. A.K. Rai
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DEPARTMENT OF CHEMISTRY

Four Year Undergraduate Program

Semester V

Course Curriculum

B.Sc. CHEMISTRY

(DSC/GEC and DSE)

Session 2024-25

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG

FOUR YEAR UNDERGRADUATE PROGRAM

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM 2024-25

CHEMISTRY

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - V		Session: **2024-2025**
1	Course Code	**BCHC - 501**		
2	Course Title	**ADVANCED CHEMISTRY - I**		
3	Course Type	**Discipline Specific Core (DSC)/ Generic Elective (GEC)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Define terms related to phase rule and Nernst distribution law and construct and interpret phase diagram and its application. • CO2: Explain principles of rotational, vibrational and electronic spectroscopy and its application. • CO3: Classify heterocyclic compounds and explain its structure, synthesis and reaction mechanisms. • CO4: Predict basicity and stereochemistry of amines, to illustrate synthetic transformation of aryl diazonium salts. • CO5: Explain thermodynamic and kinetic aspects; magnetic properties of complexes and interpret spectra of transition metal complexes.		
5	Credit Value	**3 Credits**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :**75**		Minimum Passing Marks: **30**

PART B: CONTENT OF THE COURSE		
Total no. of Teaching/ Learning Periods = 45 Periods (45 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	**PHASE EQUILIBRIUM** Phase, component and degree of freedom, Phase rule, Clausius - Clapeyron equation and its applications to Solid-Liquid, Liquid-Vapor and Solid-Vapor, limitation of phase rule. . Application of phase rule to one component system: Water and sulphur system. Application of phase rule to two component system: Pb-Ag system, desilverization of lead, Zn-Mg system, Ferric chloride-water system, congruent and incongruent melting point and eutectic point. Three component system: Liquid pairs. Nernst distribution law, Henry's law, its application and solvent extraction.	9

II	**PRINCIPLES IN SPECTROSCOPY** **Introduction**: Characterization of Electromagnetic radiation, regions of the spectrum, representation of spectra **Rotational Spectrum of Diatomic molecules**. Rigid rotor, energy levels of a rigid rotor, selection rules, pure rotational spectrum, determination of bond length, qualitative description of non-rigid rotator, isotopic effect. **Vibrational Spectroscopy:** Fundamental vibration and their symmetry, vibrating diatomic molecules, energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, determination of force constant, anharmonic oscillator. **Electronic Spectroscopy:** Basic principles, Electronic Spectra of diatomic molecule, Franck-Condon principle.	9
III	**CHEMISTRY OF NITROGEN CONTAINING COMPOUNDS** Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline medium. Reactivity, structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds and nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-Phthalimide reaction, Hofmann-Bromamide reaction, Reactions of amines, electrophilic aromatic substitution of aryl amines, Reaction of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, Azo coupling.	9
IV	**HETEROCYCLIC COMPOUNDS AND ORGANOMETALLIC REAGENT** **Heterocyclic compounds:** Classification and nomenclature, Structure, aromaticity in 5-membered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Indole (Fischer indole synthesis and Madelung synthesis), Quinoline and isoquinoline, (Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner- Miller synthesis, Bischler-Napieralski reaction, Pictet- Spengler reaction, Pomeranz-Fritsch reaction) **Organometallic reagent:** Organomagnesium compounds: Grignard reagents formation, structure and chemical reactions. Formation and chemical reactions of organozinc compounds and organolithium compounds.	9

V	**VARIOUS ASPECTS OF TRANSITION METAL COMPLEXES** **Theoretical Aspects:** Limitations of valence bond theory, Limitation of Crystal Field Theory, Application of CFSE, tetragonal distortions from octahedral geometry, Jahn–Teller distortion, square planar geometry. Qualitative aspect of Ligand field and MO Theory. **Thermodynamic and kinetic aspects of metal complexes**: 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. **Magnetic properties:** Types of magnetic behavior, methods of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of μso (spin only) and μeff. values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.	9

PART C - LEARNING RESOURCES

Text Books, Reference Books, Other Resources

Textbook Recommended :

Unified Textbook

Reference Books:

Inorganic Chemistry

1. Advanced Inorganic Chemistry, Satya Prakash.
2. Advanced Inorganic Chemistry, Agrawal & Agrawal.
3. Advanced Inorganic Chemistry, Puri & Sharma, S. Chand.
4. Inorganic Chemistry, Madan, S. Chand.

Organic Chemistry

1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2. Organic Chemistry, P.L. Soni.
3. Organic Chemistry, Bahl & Bahl.
4. Organic Chemistry, Joginder Singh.

Physical Chemistry

1. Physical Chemistry, Puri and Sharma, S. Chand.
2. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press
3. Ball, D. W. Physical Chemistry Thomson Press, India
4. G. M. Barrow, Tata McGraw Hill (Fifth Edition)

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://onlinecourses.swayam2.ac.in/cec23_cy03/preview

https://onlinecourses.nptel.ac.in/noc22_cy02/preview

https://onlinecourses.nptel.ac.in/noc24_cy05/preview

https://onlinecourses.nptel.ac.in/noc19_ch25/preview

PART D: ASSESSMENT AND EVALUATION		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **Continuous Comprehensive Evaluation (CCE):** **Semester End Exam (SEE):**	**75 Marks** **15 Marks** **60 Marks**	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test of 15 Marks and Assignment of 15 Marks	
Semester End Exam (SEE)	**Pattern -FOUR Questions (A, B, C, D) from each Unit** Question - A & B: (Compulsory) Very short answer type (01 each) Question - C: Short answer type question Question - D: Long answer type question **Total**	02 x 5 = 10 03 x 5 = 15 07 x 5 = 35 **= 60 Marks**

Name & Signature of Members of Board of Studies

Name	Signature	Departmental members:
Chairperson /H.O.D Dr. Anupama Asthana		1. Dr. V.S. Geete
Subject Expert Dr. Arun Mishra (University Nominee)	05/7/24	2. Dr. A. Kashyap
Subject Expert Dr. S. C. Tiwari		3. Dr. Sunitha B. Mathew 05.07.24
Subject Expert H. Mohabey Dr. Hemlata Mohabey.		4. Dr. Vastav Upma Shrivastava
Subject Expert Dr. Anju Jha		5.
Representative (Industry)		6.
Representative Dr. Bhawana Jain (Alumni)	B. Jain	7. Dr. A. K. Pillai
Representative Dr. S. D. Deshmukh (Professor Science Faculty Other Dept.)		8.
		9.
		10.

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG

FOUR YEAR UNDERGRADUATE PROGRAM

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM 2024-25

Chemistry Lab Course

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **V**		Session: **2024-2025**
1	Course Code	**BCHL -05**		
2	Course Title	**Lab Course -5**		
3	Course Type	**DSC/GEC**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Estimate inorganic elements by gravimetric analysis • CO2: Apply the principles of conductivity and pH and evaluate physical parameters • CO3: Prepare/synthesize organic compounds		
5	Credit Value	**1 Credit**	**1 credit =30 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **25**		Minimum Passing Marks:**10**

PART B: CONTENT OF THE COURSE	
S. No.	**List of Experiments**
I	**INORGANIC CHEMISTRY**
	Gravimetry Analysis:
	Estimation of Barium as $BaSO_4$
	Estimation of nickel (II) using Dimethylglyoxime (DMG).
	Estimation of copper as CuSCN
	Estimation of iron as Fe_2O_3 by precipitating iron as $Fe(OH)_3$.
	Estimation of Al (III) by precipitating with oxine and weighing as $Al(oxine)_3$ (aluminium oxinate).
II	**PHYSICAL CHEMISTRY**
1.	**Potentiometry/pH metry** Perform the following potentiometric/pH metric titrations: i. Strong acid vs. strong base ii. Weak acid vs. strong base iii. Dibasic acid vs. strong base iv. Potassium dichromate vs. Mohr's salt v. Determination of pKa of monobasic acid

2.	**Conductometry** • Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid. • Perform the following conductometric titrations: o Strong acid vs. strong base o Weak acid vs. strong base o Mixture of strong acid and weak acid vs. strong base o Strong acid vs. weak base • To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically
III	**ORGANIC CHEMISTRY**
	Preparation of organic compound • 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) • Benzolyation 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: a. Acetanilide by conventional methods b.Acetanilide using green approach (Bromate-bromide method) • Nitration of any one of the following: a. Acetanilide/nitrobenzene by conventional method b. Salicylic acid by green approach (using ceric ammonium nitrate). • Reduction of p-nitrobenzaldehyde by sodium borohydride. • Hydrolysis of amides and esters. • Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde. • Benzylisothiouronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid). • Aldol condensation using either conventional or green method. • Benzil-Benzilic acid rearrangement. • Preparation of sodium polyacrylate. • Preparation of urea formaldehyde. • Preparation of methyl orange. 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.

PART C - LEARNING RESOURCES

Text Books, Reference Books, Other Resources

Textbooks Recommended:

1. Vogel's Text Book of Qualitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L.Jolly, Prentice Hall.
3. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
4. Findley's Practical Physical Chemistry, B.Plevitt, Longman.
5. Experimental Physical Chemistry, R.C.Das and B. Behra, Tata McGraw Hill.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals) i. SWAYAM https://swayam.gov.in ii. e-Pathshala https://epathshala.nic.in
PART D: ASSESSMENT AND EVALUATION
Suggested Continuous Evaluation Methods: **Maximum Marks: 25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**

Semester End Exam (SEE)	**Laboratory performance: As per Dept. (LOCF)**

Name & Signature of Members of Board of Studies

Name	Signature	Departmental members:	
Chairperson /H.O.D Dr. Anupama Asthana		1. Dr.V.S.Geete	
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Subject Expert Dr. S.C. Tiwari		3. 05.07.24 Dr. Sunitha B. Mathew	
Subject Expert H. Mohabey Dr. Hemlata Mohabey		4. Dr. Vaster Upma Shrivastava	
Subject Expert Dr. Anju Jha.		5.	
Representative (Industry)		6.	
Representative Dr. Bhawana Jain B. Jain		7.	Dr. A.K.P. Mai
Representative Dr. S. D. Deshmukh (Professor Science Faculty Other Dept.)		8.	
		9.	
		10.	

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2024-25
CHEMISTRY ELECTIVE

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **V**		Session: **2024-25**
1	Course Code	**BCHE 503**		
2	Course Title	**DYES AND POLYMER CHEMISTRY**		
3	Course Type	**Discipline Specific Elective (DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Explain about various synthetic dyes and their structures • CO2: Classify dyes and discuss colour concept and chemical constitution of dyes. • CO3: Discuss various types of polymeric materials. • CO4: Describe preparation, structure, properties and application of polymers		
5	Credit Value	**3 Credit**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **100**		Minimum Passing Marks: **40**

PART B: CONTENT OF THE COURSE		
Total no. of Teaching/ Learning Periods = 45 Periods (45 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	**INTRODUCTION TO DYES** Requirements of a good dye Solubility, Linearity, Coplanarity, Fastness, Substantivity, Economic viability. Definition of fastness and its properties and Mordants with examples Explanation of nomenclature or abbreviations of commercial dyes with at least one example suffixes – G, O, R. Naming of dyes by colour index (two examples) used in dye industries. Colour and chemical constitution of dyes: Absorption of visible light, colour of wavelength absorbed and complementary colour, chromogen, chromophore, auxochrome, bathochromic and hypsochromic shifts. Relation of colour to resonance in the following classes of dyes: Azo, Triphenylmethane, Anthraquinone.	**10**
II	**CLASSIFICATION OF DYES BASED ON APPLICATION** Definition, fastness properties and applicability on substrates, examples with structures. (a) Acid dyes – Orange II, Alizarin Cyanine Green G. (b) Basic dyes – Crystal Violet, Bismark Brown. (c) Direct Cotton Dyes – Chrysophenine G. (d) Azoic dyes – Diazo components: Fast Red B Base, Fast Blue B Base; Coupling components: Naphthol AS, Naphthol AS-G. (e) Mordant dyes – Eriochrome Black T, 11 Alizarin. (f) Vat dyes – Indigo, Indanthrene (g) Disperse dyes–Celliton Scarlet B, Disperse Yellow 6G	**10**

III	**INTRODUCTION AND HISTORY OF POLYMERIC MATERIALS** Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers. Functionality and its importance: Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bifunctional systems, Poly-functional systems.	9
IV	**DETERMINATION OF MOLECULAR WEIGHT OF POLYMERS:** Determination of molecular weight of polymers (Mn, Mw, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index	8
V	**INTRODUCTION TO PREPARATION, STRUCTURE, PROPERTIES AND APPLICATION:** Polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride), polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].	8

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1. G. S. Misra, Introductory Polymer Chemistry New age International Publishers & Distributors, New Delhi
2. Introduction to Polymer Chemistry by Charles E. Carraher Jr., CRC Press
3. Polymer Science by V. R. Gwariker, N. V. Vishvanathan, Jaydev Sreedhar,New Age International Publication.
4. ATextbook of Polymer Chemistry, by Dr. M.S. Bhatnagar, S. Chand Publication.
5. .Deietrich Braun, Harald Cherdron, Matthias Rehahm, Helmut Ritter, Brigitte Voit, Polymer synthesis: Theory and practice: fundamental method experiments, fifth edition, Springer.
6. Arthur I. Vogel, A text book of Organic Chemistry including Qualitative Organic Analysis, Longman Publication London.
7. Dr. Vinay Prabha Sharma, Organic Chemistry, A Pragati Edition.
8. F G Mann, B C Saunders, Organic Chemistry, Pearson Publications

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

SWAYAM https://swayam.gov.in
e-Pathshala https://epathshala.nic.in

PART D: ASSESSMENT AND EVALUATION		
Suggested Continuous Evaluation Methods: **Maximum Marks:** 75 Marks **Continuous Comprehensive Evaluation (CCE):** 15 Marks **Semester End Exam (SEE):** 60 Marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test of 15 Marks and Assignment of 15 Marks	
Semester End Exam (SEE)	**Pattern -FOUR Questions (A, B, C, D) from each Unit** Question - A & B: (Compulsory) Very short answer type (01 each) Question - C: Short answer type question Question - D: Long answer type question **Total**	02 x 5 = 10 03 x 5 = 15 07 x 5 = 35 **= 60 Marks**

Name & Signature of Members of Board of Studies

Name	Signature	Departmental members:	
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Subject Expert (University Nominee) Dr. Arun Mishra	05/7/24	2. Dr. A. Kaulyep	
Subject Expert Dr. S. C. Tiwari		3. Dr. Sunitha Mathew	05.07.24
Subject Expert H. Mohabey (Dr. Hemlata Mohabey)		4. Dr. Vasta Upma Shrivastava	
Subject Expert (Dr. Anju Jha)		5.	
Representative (Industry)		6.	
Representative (Alumni) Dr. Bhawana Jain	13 Jan 25	7.	Dr. A.K.P. Mai
Representative Dr. S. D. Deshmukh (Professor Science Faculty Other Dept.)		8.	
		9.	
		10.	

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG

FOUR YEAR UNDERGRADUATE PROGRAM

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM 2024-25

CHEMISTRY ELECTIVE LAB COURSE

Part A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **V**		Session: **2024-25**
1	Course Code	**BCEL - 03**		
2	Course Title	**LAB COURSE ELECTIVE - 03**		
3	Course Type	**DSE**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Synthesize organic dyes in laboratory. • CO2: Prepare polymer and use it in various applications • CO3: Determine molecular weight of polymer. • CO4: Identify and classify polymers on the basis of its use in daily life		
5	Credit Value	**1 Credit**	**1 credit = 30 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **50**		Minimum Passing Marks: **20**

PART B: CONTENT OF THE COURSE	
S. No.	**List of Experiments**
1.	Synthesis of dyes: Methyl orange(azo coupling) phenolphthalein, Methyl red, Cango red, Fluorecein, Alizarin
2.	Synthesis of some polymer or project work on some polymer: polyvinyl alcohol, Rayon, PVC, Nylon6, silicon based inorganic polymer, silicone, zeolite
3.	Determination of molecular weight of polymer.
4.	Project work of identification of polymer around us in day to day life
Note:	Experiments may be added/ deleted subject to availability of time and facilities

PART C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Textbooks Recommended :

1. Deietrich Braun, Harald Cherdron, Matthias Rehahm, Helmut Ritter, Brigitte Voit, Polymer synthesis: Theory and practice: fundamental method experiments, fifth edition, Springer.
2. Arthur I. Vogel, A text book of Practical Organic Chemistry including Qualitative Organic Analysis, Longman Publication London.
3. Dr. Vinay Prabha Sharma, Practical Organic Chemistry, A Pragati Edition.
4. F G Mann, B C Saunders, Practical Organic Chemistry, Pearson Publications

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

SWAYAM https://swayam.gov.in

e-Pathshala https://epathshala.nic.in

PART D: ASSESSMENT AND EVALUATION	
Suggested Continuous Evaluation Methods: **Maximum Marks: 25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

Name	Signature	Departmental members:
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Subject Expert	Dr. S.C. Tiwari	3. ..... 05.07.24 Dr. Sunitha B. Mathew
Subject Expert	H. Mohabey (Dr. Hemlata Mohabey)	4. ..... Uma Shrivastava
Subject Expert	(Dr. Anju Jha) 05/07/24	5. ....
Representative (Industry)	.....	6. ....
Representative (Alumni)	Dr. Bhavana Jain B. Jain	7. ..... M. A. K. Patel
Representative (Professor Science Faculty Other Dept.)	Dr. S. D. Deshmukh	8. ....
		9. ....
		10. ....

DEPARTMENT OF CHEMISTRY

Four Year Undergraduate Program

Semester VI

Course Curriculum

B.Sc. CHEMISTRY

(DSC/GEC and DSE)

Session 2024-25

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG

FOUR YEAR UNDERGRADUATE PROGRAM

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM 2024-25

CHEMISTRY

PART A: INTRODUCTION				
Program: **FYUP**		**Class: B.Sc.**	**Semester - VI**	**Session:2024-25**
1	Course Code	**BCHC-601**		
2	Course Title	**ADVANCED CHEMISTRY - II**		
3	Course Type	**Discipline Specific Core (DSC)/Generic Elective (GEC)**		
4	Course Learning Outcome (CLO)	**This course will enable the students to:** • CO1: Give nomenclature, classification, structure and properties of organometallics. • CO2: Identify trace and essential elements in biological process, explain role of bioinorganic molecules and inorganic polymers. • CO3: Categorize and name various biomolecules and explain their structures and properties. • CO4: Explain basic principles of UV-Visible, IR and NMR and interpretation of spectra. • CO5: Discuss the principles and applications in electrochemistry; illustrate electrochemical cell and its applications		
5	Credit Value	**3 Credits**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **75**		Minimum Passing Marks: **30**

PART B: CONTENT OF THE COURSE		
Total no. of Teaching/ Learning Periods = 45 Periods (45 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	**ORGANO-METALLIC 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. **Catalysis by Organometallic Compounds –** Study of the following industrial processes and their mechanism : 1. Alkene hydrogenation (Wilkinsons Catalyst) 2. Polymeration of ethane using Ziegler – Natta Catalyst	**10**

II	**BIOINORGANIC CHEMISTRY AND INORGANIC POLYMERS** **Bioinorganic 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 Ca^{2+} and Mg^{2+}, nitrogen fixation. **Inorganic polymers:** Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones. Silicates, phosphazenes and polyphosphate.	8
III	**BIO-MOLECULES** **Carbohydrates:** Occurrence, classification and their biological importance. 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 structures; Interconversions of aldoses and ketoses; Killiani Fischer synthesis and Ruff degradation; chemical reactions of glucose and fructose. Disaccharides – Structural comparison of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch and cellulose. **Amino acids, proteins and nucleic acids:** Classification and Nomenclature of amino acids, Configuration and acid base properties of amino acids, Isoelectric Point, Peptide bonds, Protein structure, denaturation/ renaturation, Constituents of nucleic acid, DNA, RNA nucleoside, nucleotides, double helical structure of DNA.	9
IV	**ORGANIC SPECTROSCOPY** **UV-Visible spectroscopy:** Beer Lambert's law, effect of Conjugation, λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, types of electronic transitions, Intensity of absorption, Visible spectrum and colour. **Infrared spectroscopy:** Basic principle, IR absorption band, their position and intensity, IR spectra of organic compounds. **NMR spectroscopy:** Basic principles of Proton Magnetic Resonance, Tetramethyl silane (TMS) as internal standard, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant (J); Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple organic compounds.	9

V	**ELECTROCHEMISTRY** **Electrolytic conductance:** Specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Kohlrausch law, application of Kohlrausch law in determination of dissociation constant of weak electrolyte, solubility of sparingly soluble electrolyte, absolute velocity of ions, ionic product of water. **Theories of strong electrolyte:** Limitations of Ostwald's dilution law, weak and strong electrolytes, Elementary ideas of Debye-Huckel theory, Debye-Huckel-Onsager's equation for strong electrolytes, relaxation and electrophoretic effects. **Electrochemical cell and Galvanic cells**: Reversible and irreversible cells, conventional representation of electrochemical cells, EMF of the cell and effect of temperature on EMF of the cell, Nernst equation, Calculation of ΔG for cell reactions. Single electrode potential, types of electrodes, standard hydrogen electrode, calomel electrode, quinhydrone electrode, electrochemical series.	9

PART C - LEARNING RESOURCES

Text Books, Reference Books, Other Resources

Textbooks Recommended:

Unified Textbooks

Reference Books:

Inorganic Chemistry

1. Advanced Inorganic Chemistry, Satya Prakash.
2. Advanced Inorganic Chemistry, Agrawal & Agrawal.
3. Advanced Inorganic Chemistry, Puri & Sharma, S. Chand.
4. Inorganic Chemistry, Madan, S. Chand.

Organic Chemistry

1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2. Organic Chemistry, P.L. Soni.
3. Organic Chemistry, Bahl & Bahl.
4. Organic Chemistry, Joginder Singh.

Physical Chemistry

1. Physical Chemistry, Puri and Sharma, S. Chand.
2. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press
3. Ball, D. W. Physical Chemistry Thomson Press, India
4. G. M. Barrow, Tata McGraw Hill (Fifth Edition)

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://onlinecourses.nptel.ac.in/noc22_cy01/preview
https://archive.nptel.ac.in/courses/104/106/104106075/
https://archive.nptel.ac.in/courses/104/106/104106137/

PART D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks:	**75 Marks**
Continuous Comprehensive Evaluation (CCE):	**15 Marks**
Semester End Exam (SEE):	**60 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test of 15 Marks and Assignment of 15 Marks	
Semester End Exam (SEE)	**Pattern -FOUR Questions (A, B, C, D) from each Unit**	
	Question - A & B: (Compulsory) Very short answer type (01 each)	02 x 5 = 10 Marks
	Question - C: Short answer type question	03 x 5 = 15 Marks
	Question - D: Long answer type question	07 x 5 = 35 Marks
	Total	**= 60 Marks**

Name & Signature of Members of Board of Studies

Name	Signature
Chairperson /H.O.D Dr. Anupama Asthana	
Subject Expert Dr. Arun Mishra (University Nominee)	05/7/24
Subject Expert Dr. S.C. Tiwari	
Subject Expert H. T. Mahabey (Dr. Hemlata Mohabey)	
Subject Expert 05/07/24 (Dr. Anju Jha)	
Representative (Industry)	
Representative Dr. Bhawana Jain (Alumni)	B. Jain
Representative Dr. S.D. Deshmukh (Professor Science Faculty Other Dept.)	

Departmental members:

1.	Dr. V.S. Geete	
2.	Dr. A. Kashyap	
3.	(Dr. Sunitha Mathew)	
4.	Vyas Upma Shrivastava	
5.		
6.		
7.	M. A. K. Patel	
8.		
9.		
10.		

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG

FOUR YEAR UNDERGRADUATE PROGRAM

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM 2024-25

CHEMISTRY LAB COURSE

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **V**		Session: **2024-2025**
1	Course Code	**BCHL -05**		
2	Course Title	**Lab Course -5**		
3	Course Type	**DSC/GEC**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Separate components of binary organic mixture and identify organic compounds by systematic qualitative analysis • CO2: Apply the principles of UV-Visible spectroscopy and determine various parameters • CO3: Prepare/synthesize and characterize inorganic compounds		
5	Credit Value	**1 Credit**	**1 credit =30 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **25**		Minimum Passing Marks: **10**

PART B: CONTENT OF THE COURSE	
S. No.	**List of Experiments**
I	**ORGANIC CHEMISTRY**
	Qualitative Analysis: Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, NaOH for separation and preparation of suitable derivatives.
II	**PHYSICAL CHEMISTRY**
	UV/ Visible spectroscopy
1	Verify Lambert-Beer's law and determine the concentration of $CuSO_4$/ $KMnO_4$ / $K_2Cr_2O_7$ in a solution of unknown concentration.
2	Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture.
3	Study the kinetics of iodination of propanone in acidic medium.
4	Determine the amount of iron present in a sample using 1, 10 - phenathroline.
5	Determine the dissociation constant of an indicator (phenolphthalein).
6	Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.

7	Study of pH-dependence of the UV-Vis spectrum (200-500 nm) of potassium dichromate.
8	Spectral characteristics study (UV) of given compounds (acetone, acelaldehyde, acetic acid, etc.) in water.
9	Absorption spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine □max values.
III	**INORGANIC CHEMISTRY**
	Inorganic Preparations: • Tetraamminecopper (II) sulphate, [Cu(NH3)4]SO4.H2O • Cis and trans K[Cr(C2O4)2. (H2O)2] 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) Characterization of the above preparation by UV-Visible spectroscopic method
Note:	Experiments may be added/ deleted subject to availability of time and facilities

PART C - LEARNING RESOURCES

Text Books, Reference Books, Other Resources

Textbooks Recommended:

1. Vogel's Text Book of Qualitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L.Jolly, Prentice Hall.
3. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
4. Findley's Practical Physical Chemistry, B.Plevitt, Longman.
5. Experimental Physical Chemistry, R.C.Das and B. Behra, Tata McGraw Hill.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

i. SWAYAM https://swayam.gov.in

ii. e-Pathshala https://epathshala.nic.in

PART D: ASSESSMENT AND EVALUATION	
Suggested Continuous Evaluation Methods: **Maximum Marks: 25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	**Laboratory performance: As per Dept. (LOCF)**

Name & Signature of Members of Board of Studies

Name	Signature	Departmental members:
Chairperson /H.O.D Dr. Anupama Asthana		1. Dr. V.S. Geete .....
Subject Expert Dr. Arun Mishra (University Nominee)	05/7/24	2. Dr. A. Kashyap
Subject Expert Dr. S.C. Tiwari	S.C.	3. Dr. Sunitha Mathew 05.07.24
Subject Expert H. Mahabey Dr. Hemlata Mohabey		4. Upma Shrivastava
Subject Expert Dr. Anju Jha		5. .....
Representative (Industry)		6. .....
Representative Dr. Bhavana Jain (Alumni)	B. Jain	7. Dr A.K.P. Mau
Representative Dr. S. D. Deshmukh (Professor Science Faculty Other Dept.)		8. .....
		9. .....
		10. .....

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2024-25
CHEMISTRY ELECTIVE

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VI**		Session: **2024-25**
1	Course Code	**BCHE 604**		
2	Course Title	**INSTRUMENTAL METHODS OF ANALYSIS**		
3	Course Type	**Discipline Specific Elective (DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Select appropriate sampling technique based on sample and target analytes. • CO2: Explain principle and instrumentation involved in AAS. CO3: Select proper technique among optical techniques and apply its principle. • CO4: Illustrate principle and applications of polarography. • CO5: Describe principle, instrumentation and applications of bases on turbidity electro-analytical techniques.		
5	Credit Value	**3 Credit**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **100**		Minimum Passing Marks: **40**

PART B: CONTENT OF THE COURSE		
Total no. of Teaching/ Learning Periods = 45 Periods (45 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	**SAMPLING AND SAMPLE TREATMENT** Criteria for representative sample. Techniques of sampling of gases (ambient air and exhaust gases), liquids (water and milk samples), solids (soil and coal samples) and particulates. Hazards in sampling. Safety aspects in handling hazardous chemicals. Sample dissolution methods for elemental analysis: Dry and wet ashing, acid digestion, fusion processes and dissolution of organic samples. Detection and quantification: Concepts and difference between sensitivity, limit of detection and limit of quantification, role of noise in determination of detection limit of analytical techniques. Methods of quantification: Absolute method, comparison method, calibration curve method, standard addition method and internal standard method.	9
II	**ATOMIC ABSORPTION SPECTROSCOPY** Principle. Atomic energy levels. Grotrian diagrams. Population of energy levels. Instrumentation. Sources: Hollow cathode lamp and electrodeless discharge lamp, factors affecting spectral width. Atomizers: Flame atomizers, graphite rod and graphite furnace. Cold vapors and hydride generation techniques. Factors affecting atomization efficiency, flame profile. Monochromators and detectors. Beam modulation. Detection limit and sensitivity. Interferences and their removal. Comparison of AAS and flame emission spectrometry. Applications of AAS.	9

III	**FLUOROMETRY AND PHOSPHORIMETRY** Principles of fluorescence and phosphorescence. Jablonski diagram. Concentration dependence of fluorescence intensity. Fluorescence quenching. Instrumentation. Applications. **PHOTOACOUSTIC SPECTROSCOPY** Theory. Instrumentation. Advantages over absorption spectroscopy. Chemical and surface applications of PAS	9
IV	**POLAROGRAPHY** Principle of DC polarography. Instrumentation in polarography. Advantages and limitations of DME. Types of currents- residual current, migration current, diffusion current, limiting current, adsorption current, kinetic current and catalytic current. Ilkovic equation-diffusion current constant and capillary characteristics. Derivation of equation of polarographic wave and half wave potential. Experimental determination of half wave potential. Reversible, quasi reversible and irreversible electrode reactions. Polarographic maxima and maximum suppressor. Oxygen interference and deaeration. Introduction to pulse, a.c. and oscillographic techniques and their advantages. Applications of polarography in determination of dissolved oxygen, metal ion quantification and speciation, simultaneous determination of metal ions, analysis of organic compounds. Limitations of polarography.	10
V	**AMPEROMETRY** Amperometric titrations: Principle, types and applications in analytical chemistry. **NEPHELOMETRY AND TURBIDIMETRY** Principle, instrumentation, and applications.	8

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1. Anderson, R. (1986). Sample pre-treatment and separation. John Wiley and Sons.
2. Bassett, J., Denney, R. C., Jeffery, G. H., & Mendham, J. (1986). Vogel's textbook of quantitative inorganic analysis.
3. Bhatt, B. I., & Vora, S. M. (2008). Stoichiometry (2nd ed.). Tata McGraw-Hill Publishing Company Ltd.
4. Braun, R. D. (2004). Instrumental methods of chemical analysis. Tata McGraw-Hill Education.
5. Christian, G. D. (2013). Analytical chemistry. Wiley India.
6. Day, R. A., & Underwood, A. L. (1986). Quantitative analysis. Prentice-Hall of India.
7. Anderson, R. (1986). Sample pre-treatment and separation. John Wiley and Sons.
8. Bassett, J., Denney, R. C., Jeffery, G. H., & Mendham, J. (1986). Vogel's textbook of quantitative inorganic analysis.
9. Bhatt, B. I., & Vora, S. M. (2008). Stoichiometry (2nd ed.). Tata McGraw-Hill Publishing Company Ltd.

Text Books/ Reference Books:

10. Braun, R. D. (2004). Instrumental methods of chemical analysis. Tata McGraw-Hill Education.
11. Christian, G. D. (2013). Analytical chemistry. Wiley India.
12. Day, R. A., & Underwood, A. L. (1986). Quantitative analysis. Prentice-Hall of India.
13. Ewing, G. W. (1975). Instrumental methods of chemical analysis. G. W. Ewing.
14. Chatwal, G., & Anand, S. (2013). Instrumental methods of analysis. Himalaya Publishing House.
15. Khopkar, S. M. (1997). Analytical chemistry: Problems and solutions. New Age International Publishers.
16. Khopkar, S. M. (2003). Basic concepts in analytical chemistry. New Age International Publishers.
17. Meites, L., & Thomas, H. C. (1977). Advanced analytical chemistry. McGraw-Hill.
18. Meites, L., & Thomas, H. C. (1990). Advance analytical chemistry: Meites and Thomas. McGraw-Hill.
19. Skoog, D. A., & West, D. M. (1976). Fundamentals of analytical chemistry.
20. Shyder, L. R., & Harvath, C. H. (1983). An introduction to separation science. Wiley Interscience.
21. Sane, S. S., & Joshi, M. V. (2011). Electroanalytical chemistry. Quest Publications.
22. Kolthoff, I. M., & Lingane, J. J. (1952). Polarography.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://people.umass.edu/~mcclemen/581Sampling.html

https://nptel.ac.in/courses/104105084

https://egyankosh.ac.in/bitstream/123456789/43329/1/Unit-8.pdf

https://mvpsvktcollege.ac.in/wp-content/uploads/2022/11/1-TYAAS.pdf

https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/downloads/FLUORIMETRY.pdf https://courseware.cutm.ac.in/wp-content/uploads/2020/06/nephelometry-and-turbidimetry.pdf

https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplem

PART D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:	
Maximum Marks:	**75 Marks**
Continuous Comprehensive Evaluation (CCE):	**15 Marks**
Semester End Exam (SEE):	**60 Marks**
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test of 15 Marks and Assignment of 15 Marks

Semester End Exam (SEE)	**Pattern -FOUR Questions (A, B, C, D) from each Unit**	
	Question - A & B: (Compulsory) Very short answer type (01 each)	02 x 5 = 10
	Question - C: Short answer type question	03 x 5 = 15
	Question - D: Long answer type question	07 x 5 = 35
	Total	**= 60 Marks**

Name & Signature of Members of Board of Studies

Name	Signature	Departmental members:	
Chairperson /H.O.D Dr. Anupama Asthana		1.	Dr. V.S. Geete
Subject Expert Dr. Arun Mishra (University Nominee)	05/7/24	2.	Dr. A. Kaulyap
Subject Expert Dr. S.C. Tiwari		3.	Dr. Sunitha Mathew 05.07.24
Subject Expert Dr. Hemlata Mohabey		4.	Upma Srivastava
Subject Expert Dr. Anju Jha		5.	
Representative (Industry)		6.	
Representative Dr. Bhawana Jain (Alumni)	B. Jain	7.	Dr. A.K. Pillai
Representative Dr. S.D. Deshmukh (Professor Science Faculty Other Dept.)		8.	
		9.	
		10.	

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG

FOUR YEAR UNDERGRADUATE PROGRAM

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM 2024-25

CHEMISTRY ELECTIVE LAB COURSE

Part A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VI**		Session: **2024-25**
1	Course Code	**BCEL - 04**		
2	Course Title	**LAB COURSE ELECTIVE - 04**		
3	Course Type	**DSE**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Determine half wave potential and unknown concentration of metal ions using polorography or amperometry. • CO2: Understand the working principle of UV-visible and Atomic absorption spectroscopy and perform experiments based on it. • CO3: Handle flame photometer and explain fluorescence quenching • CO4: To determine concentration of ions in different samples by Nephelo Turbidometry.		
5	Credit Value	**1 Credit**	**1 credit = 30 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : **50**		Minimum Passing Marks: **20**

PART B: CONTENT OF THE COURSE	
S. No.	**List of Experiments**
1.	**Polarography and Amperometry:** • Determination of half wave potential E1/2 and unknown concentration of Cu/Pb/Zn ion. • Amperometric titration of $Pb(NO_3)_2$ with $K_2Cr_2O_7$.
2.	**Absorption spectroscopy:** • Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds. • To determine lambda max (λmax) of phenol and effects of solvents on absorption spectra of phenol. • Assay of paracetamol by UV- Spectrophotometry • Determination of the amount of Ca in a sample using the standard calibration curve-Atomic Absorption Spectroscopy (AAS).
3.	**Fluorimetry and Flame Photometry:** • To perform the assay of Riboflavin tablets by fluorimetry • Estimation of quinine sulfate by fluorimetry • Study of quenching of fluorescence • Study the effect of concentration in fluorescence intensity of quinine sulphate solution. • Determination concentration of sodium in given unknown sample by Flame photometry • Determination concentration of potassium in given unknown sample by Flame photometry

4.	**Nephelometry and turbidimetry:** • To determine phosphate ion concentration in water sample by Nephelo Turbidometry. • To determine sulphate and/or chloride ion concentration in water sample by Nephelo-Turbidometry.
Note:	Experiments/ Demonstration may be added/ deleted or Tutorials may be conducted subject to availability of time and facilities

PART C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Textbooks Recommended :

1. Sharma, B. K. (1981). Instrumental methods of chemical analysis. Krishna Prakashan Media.
2. Badwaik, H. R., Thote L.K.; Giri, T.K. (2022). Practical Handbook: Instrumental methods of analysis. Vallabh Prakashan. Delhi, India.
3. Vogel, A. I., & Jeffery, G. H. (1989). Vogel's textbook of quantitative chemical analysis. (No Title). Stenlake, J. B. (1976). Practical pharmaceutical chemistry. Athlone Press.
4. Sethi, P. D. (1985). Quantitative analysis of drugs in pharmaceutical formulations. Unique Publishers.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

https://egyankosh.ac.in/bitstream/123456789/43329/1/Unit-8.pdf

https://mlrip.ac.in/wp-content/uploads/2022/03/INSTRUMENTAL-METHODS-OF-ANALYSISLAB- MANUAL.pdf

https://www.studyandscore.com/studymaterial-detail/flame-photometer-principle-components working-procedure-applications-advantages-and-disadvantages

https://www.youtube.com/watch?v=DFQd0Ncj76w

https://www.studocu.com/en-ie/document/national-university-of-ireland-maynooth/analytical chemistry/ch202-experiment-7-atomic-absorption-spectroscopy-determination-of-the-amount-of copper-and-zinc/7019987

https://www.scribd.com/document/434710621/EXP-4-AAS

PART D: ASSESSMENT AND EVALUATION	
Suggested Continuous Evaluation Methods: **Maximum Marks: 25 Marks** **(Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)**	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

Name	Signature
Chairperson /H.O.D	Dr. Anupama Asthana
Subject Expert (University Nominee)	Dr. Arun Mishra 05/7/24
Subject Expert	Dr. S.C. Tiwari
Subject Expert	Dr. Hemlata Mohabey H. Mohabey
Subject Expert	Dr. Anju Jha.
Representative (Industry)	
Representative (Alumni)	Dr. Bhawana Jain B. Jain
Representative (Professor Science Faculty Other Dept.)	Dr. S.D. Deshmukh

Departmental members:

1. Dr. U.S. Geete
2. Dr. A. Kashyap
3. Dr. Sunita Mathew 05/07/24
4. Vpma Shrivastava
5. .....
6. .....
7. Dr. A.K. Rai
8. .....
9. .....
10. .....

B.Sc. (CHEMISTRY)
2024-25
Skill Enhancement Course – 1
BCHS 01: GOOD LAB PRACTICES IN CHEMISTRY
THEORY AND PRACTICAL
[Credits -02 (Th-01, 15 hrs.; Practical-01, 30 hrs.)]

Course outcome:

After completing the course students will be able to:

CO1: Understand general laboratory practices
CO2: Prepare solutions
CO3: Handle glassware's and chemicals
CO4: Explore various research issues and their solutions
CO5: Apply practical skills in chemistry

THEORY

A. Common calculations in chemistry laboratories. Understanding the details on the label of reagent bottles.
Inorganic and organic reagents (Baeyer's reagent, Nessler's reagent, Fehling solution A and B, Shiff reagents, Tollen's reagent, Molish's reagent, Neutral ferric chloride, Nitrating Mixture, Aqua regia, Dimethyl glyoxime, H_2S gas); chemicals such as acids, bases, indicators, etc. used in chemistry lab for qualitative analysis .

B. Molarity and normality of common acids and bases. Preparation of solutions – solid and liquids, Molar, Molal and Normal solutions, Dilutions. Percentage solutions.

PRACTICAL

A. Technique and uses of handling glass wares; calibrations, knowledge about common toxic chemicals and safety measures in their handling.

B. Qualitative test of CO_3^{2--}, CH_3COO^-, SO_4^{2-}, Cl^-, NO_3^-, NH_4^+, Cu_2^+, Fe^{3+}, Ni^{2+}, Ba^{2+}, Mg^{2+}

Or

Preparation of standard solutions of solids and liquids – Normal, Molar and percentage solutions; dilutions.

C. Qualitative elemental analysis for Nitrogen, Sulphur, Halogen in organic compounds.

Or

Preparation of inorganic and organic reagents - Baeyer's reagent, Nessler's reagent, Fehling solution A and B, Shiff reagents, Tollen's reagent, Molish's reagent, Neutral ferric chloride, Nitrating Mixture, Aqua regia and their application in analysis.

Reference Books

1. Seiler, J.P. (2005). Good Laboratory Practices: the why and how. Springer-Verlag Berlin andHeidelberg GmbH & Co. K; 2nd ed.
2. Garner, W.Y., Barge M.S., Ussary. P.J. (1992). Good Laboratory Practice Standards: Application for field and Laboratory studies. Wiley VCH.

Distribution of Marks

Total Marks: Theory - 25 marks and **Practical/Project - 25** marks
Pattern of Examination: Out of 10, five questions to be attempted
(Question Paper pattern and Weightage of marks of internal examinations (if any) will be included as per guidelines of CGHE/University/Autonomous Examination Cell for the particular Academic Session)

B.Sc. (CHEMISTRY)
2024-25
Skill Enhancement Course – 2
BCHS 02: WATER REMEDIATION AND CONSERVATION STUDIES THEORY AND PRACTICAL
[Credits -02 (Th-01, 15 hrs.; Practical-01, 30 hrs.)]

Course outcome:

After completing the course students will be able to:

CO1: Understand about Sources and Effect of Water Pollution
CO2: Learn about various control technique

THEORY:

Water Pollution
Sources of water pollutants, pollutants, Industrial and human contribution, WHO recommendation about potable water, current scenario of drinking water quality.

Remediation Techniques
Remediation, techniques involved such as adsorption, coagulation-filtration, Nalgonada techniques, reverse osmosis, activated charcoal detoxification, mechanisms of detoxification, bio-remediation, need of green chemistry, future scope.

Water Conservation
Introduction to water conservation and erosion of soil, forms of water erosion, factors affecting water erosion, types of water erosion, mechanics of water erosion control,

PRACTICAL:
Water analysis (pH, Conductivity, hardness, Acidity, Alkalinity etc.)

Case study/Project
Case study/Project on water pollution, water conservation and water quality.

Recommended Books/references:
1. Cittenden J. C. , Trussell J. R., Hand D. W., Howe K. J., Tchobanoglous G. , Water treatment: Principles and Design MWH publication.
2. De A. K. Environmental Chemistry, Wiley Eastern
3. Clarson D., Dara S. S. A text book of Environmental chemistry and pollution control, S Chand Co. Soil and water analytical method
4. Edzwald J., Water Quality & Treatment: A Handbook on Drinking Water (Water Resources and Environmental Engineering Series)

Distribution of Marks

Total Marks: Theory - 25 marks and **Practical/Project - 25** marks
Pattern of Examination: Out of 10, five questions to be attempted
(Question Paper pattern and Weightage of marks of internal examinations (if any) will be included as per guidelines of CGHE/University/Autonomous Examination Cell for the particular Academic Session)

B.Sc. (CHEMISTRY)
2024-25
Skill Enhancement Course – 3
BCHS 03: GREEN CHEMISTRY
THEORY AND PRACTICAL
[Credits -02 (Th-01, 15 hrs.; Practical-01, 30 hrs.)]

Course outcome:

After completing the course students will be able to:

CO1: Understand need, goals, and obstacles in green chemistry.
CO2: Design green solvents and green reactions.
CO3: Understand and use of twelve principles of green chemistry.
CO4: Interpret and execute case study, survey, and projects on green chemistry.

THEORY:

What is Green Chemistry?
Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry.

Principles of Green Chemistry and Designing a Chemical synthesis:
Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following:

- Designing a Green Synthesis using these principles; Prevention of Waste/ by products; maximum incorporation of the materials used in the process into the final products, Atom Economy, addition, substitution, and elimination reactions.
- Prevention/ minimization of hazardous/ toxic products reducing toxicity, and risks; waste or pollution prevention hierarchy.
- Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solventless processes, immobilized solvents and how to compare greenness of solvents. Future Trends in Green Chemistry: Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; Green chemistry in sustainable development].

PRACTICAL:

- Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis).
- Microwave assisted reactions in water: Hofmann elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions 30 For 2 Credits SEC in organic solvents Diels-Alder reaction and Decarboxylation reaction.
- Right fit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.
- An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.

Case study/Project

Case study/Project on Green chemistry, Role of green chemistry in lab safety, and implications of green chemistry.

Recommended Books/references:

1. Perosa, A., & Zecchini, F. (2007). Methods and reagents for green chemistry: an introduction. John Wiley & Sons.

2. Clark, J. H., & Macquarrie, D. J. (Eds.). (2008). Handbook of green chemistry and technology. John Wiley & Sons.
3. Ameta, S. C., & Ameta, R. (Eds.). (2023). Green Chemistry: Fundamentals and Applications. CRC press.
4. Anastas, P. T. (Ed.). (2013). Handbook of green chemistry (Vol. 1). Wiley-VCH.

Distribution of Marks

Total Marks: Theory - 25 marks and **Practical/Project - 25** marks
Pattern of Examination: Out of 10, five questions to be attempted
(Question Paper pattern and Weightage of marks of internal examinations (if any) will be included as per guidelines of CGHE/University/Autonomous Examination Cell for the particular Academic Session)

The course curriculum of the Skill Enhancement Courses for B.Sc. (Chemistry) is hereby approved for the Session 2024-25.

Name & Signature of Members of Board of Studies

	Name	Signature
Chairperson /H.O.D	Dr. Anupama Asthana	
Subject Expert (University Nominee)	Dr. Arun Mishra	05/7/24
Subject Expert	Dr. S. C. Tiwari	
Subject Expert	(Dr. Hemlata Mohabey)	H. Mohabey
Subject Expert	(Dr. Anju Jha)	
Representative (Industry)		
Representative (Alumni)	Dr. Bhawana Jain	B. Jain
Representative (Professor Science Faculty Other Dept.)	Dr. S. D. Deshmukh	

Departmental members:

1. Dr. V. S. Geete
2. Dr. A. Kashyap
3. 05/07/24 Dr. Sunitha B. Mathew
4. Upma Shrivastava
5.
6.
7. Dr. A. K. Pillai
8.
9.
10.