DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM & MARKING SCHEME

B.Sc. V, VI, VII, VIII Semester

CHEMISTRY

(Based on Choice Based Credit System)

SESSION : 2025-26

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

SYLLABUS

DEPARTMENT OF CHEMISTRY

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

FOUR YEAR UNDERGRADUATE PROGRAM
(2022-26 & 2023-27)

SEMESTER V, VI, VII & VIII

CHEMISTRY
COURSE CURRICULUM
SESSION 2025-26

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26

The NEP Course Curriculum & Marking Scheme for FYUP (Chemistry) Semester – V, VI, VII & VIII is hereby approved by members of Board of Studies for the Session 2025-26.

NAME AND SIGNATURE:

	Name	Signature
Chairperson /H.O.D		
Subject Expert (University Nominee)		
Subject Expert		
Subject Expert		
Subject Expert		
Representative (Industry)		
Representative (Alumni)		
Representative (Professor Science Faculty Other Dept.)		

Departmental members:

1. Dr. Ajai Pillai
2. .....
3. Dr. P. Kathane
4. Dr. Varsha Joshi
5. Dr. Sunitha Mathew
6. Dr. Neha Jha
7. Dr. Sameer
8. .....
9. .....
10. .....

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
CHEMISTRY COURSE CURRICULUM SCHEME (Sessions: 2022-26 & 2023-27)

DSC			DSE			GE		
Sem.	**Code**	**Title**	**Sem.**	**Code**	**Title**	**Sem.**	**Code**	**Title**
I	BCHC-101	Fundamentals of Chemistry - I	-	-	-	I	BCHC-101	Fundamentals of Chemistry - I
II	BCHC-201	Fundamentals of Chemistry - II	-	-	-	II	BCHC-201	Fundamentals of Chemistry - II
III	BCHC-301	Concepts in Chemistry -I	III	BCHE-302	Environmental Chemistry	III	BCHC-301	Concepts in Chemistry -I
IV	BCHC-401	Concepts in Chemistry -II	IV	BCHE-402	Analytical Chemistry	IV	BCHC-401	Concepts in Chemistry -II
V	BCHC-501	Advanced Chemistry -I	V	BCHE-502	Dyes & Polymer Chemistry	V	BCHC-501	Advanced Chemistry -I
			V	BCHE-503	Photochemistry & Pericyclic Reactions			
VI	BCHC-601	Advanced Chemistry -II	VI	BCHE-602	Instrumental Methods of Analysis	VI	BCHC-601	Advanced Chemistry -II
			VI	BCHE-603	Heterocyclic Chemistry			
VII	BCHC-701	Inorganic Chemistry - I	VII	BCHE-702	Physical Chemistry - I	**SEC**		
			VII	BCHE-703	Organic Chemistry - I	I/III/V	CHSE -01	Good Lab Practices in Chemistry
			VII	BCHE-704	Analytical Chemistry - I	II/IV/VI	CHSE-02	Water remediation & Conservation
			VII	BCHE-705	Polymer Chemistry	VIII		
Semester VIII Common Courses for both CGPA less than & greater than 7.5								
VIII	BCH-801	Organic Chemistry - II	VIII	BCHE-802	Analytical Chemistry – II			
Courses for those with CGPA less than 7.5						**CGPA greater than 7.5**		
			VIII	BCHE-803	Inorganic Chemistry - II	**Dissertation**		
			VIII	BCHE-804	Physical Chemistry - II			
			VIII	BCHE-805	Nanomaterials and Nanotechnology			

Name and Signatures

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG

Approved Syllabus for B.Sc. CHEMISTRY by the Members of Board of Studies for the Session 2025-26

Scheme and Syllabus for B.Sc. Year 3 (Semester V & VI)

Courses and Marking Scheme for Third-Year FYUP with Chemistry

Year	Sem.	Course Code	Paper Title	Theory/ Practical	Credits	Marks	Sem End	IA
For Degree								
Discipline Specific Courses – DSC (Core Courses)/Generic Elective Course - GEC								
3	V	BCHC 501	Advanced Chemistry - I	Theory	3	100	80	20
		BCHL 501	Lab Course - 5	Practical	1	50	50	
	VI	BCHC 601	Advanced Chemistry - II	Theory	3	100	80	20
		BCHL 601	Lab Course - 6	Practical	1	50	50	
3	**Skill Enhancement Courses - SEC**							
	V	BCHS 01	Good lab practices in Chemistry	Theory	2	50	40	
				Project			10	
	VI	BCHS 02	Internship/ Project/ Community Outreach	*As per Guidelines (Autonomous Cell)	2	50	*50	
Discipline Specific Electives – DSE 1 & 2								
3	V	DSE-1 BCHE 502	Environmental Chemistry & Lab Course - 1	Theory	3	100	80	20
				Practical	1	50	50	
		DSE-2 BCEL 503	Photochemistry and Pericyclic Reactions & Lab Course - 2	Theory	3	100	80	20
				Practical	1	50	50	
	VI	DSE-1 BCHE 602	Analytical Chemistry & Lab Course - 1	Theory	3	100	80	20
				Practical	1	50	50	
		DSE-2 BCEL 603	Heterocyclic Chemistry & Lab Course - 2	Theory	3	100	80	20
				Practical	1	50	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%

Scheme and Syllabus for B.Sc. Year 4 (Semester VII & VIII)
Courses and Marking Scheme for Fourth-year UG with Chemistry

Year	Sem	Course Code	Paper Title	Theory/ Practical	Credits	Marks	Sem End	IA
For Bachelor Degree with Honours'/ Honours' with Research*								
Discipline Specific Courses – DSC (Core Courses)/ Generic Elective Course - GEC								
4	VII	BCHC 701	Inorganic Chemistry – I	Theory	3	75	60	15
		BCHL 701	Lab Course 7A: Inorganic	Practical	1	25	25	
	VIII	BCHC 801	Organic Chemistry - II	Theory	3	75	60	15
		BCHL 801	Lab Course 8A: Organic	Practical	1	25	25	
Discipline Specific Electives – DSE – 1, 2, 3 & 4								
4	VII	DSE-1 BCHE 702	Physical Chemistry - I	Theory	3	75	60	15
			Lab Course 7B: Physical	Practical	1	25	25	
		DSE-2 BCHE 703	Organic Chemistry - I	Theory	4	100	80	20
		DSE-3 BCHE 704	Analytical Chemistry - I	Theory	4	100	80	20
		DSE-4 BCHE 705	Polymer Chemistry	Theory	4	100	80	20
Discipline Specific Electives DSE - 1, 2, 3 & 4 (For CGPA less than 7.5)								
4	VIII	DSE-1 BCHE 802	Analytical Chemistry - II	Theory	3	75	60	15
			Lab Course 8B: Analytical	Practical	1	25	25	
		DSE-2 BCHE 803	Inorganic Chemistry - II	Theory	4	100	80	20
		DSE-3 BCHE 804	Physical Chemistry - II	Theory	4	100	80	20
		DSE-4 BCHE 805	Nanomaterials & Nanotechnology	Theory	4	100	80	20
Discipline Specific Electives DSE – 1 (For CGPA greater than 7.5)*								
4	VIII	DSE-1 BCHE 802	Analytical Chemistry - II	Theory	3	75	60	15
			Lab Course 8B: Analytical	Practical	1	25	25	
			Research Project/ Dissertation	Research work	12	300	300	

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%

DEPARTMENT OF CHEMISTRY

Four Year Undergraduate Program

Semester V

Course Curriculum

B.Sc. CHEMISTRY

(DSC/GEC and DSE)

Session 2025-26

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **V**		Session: **2025-2026**
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 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	**PHASE EQUILIBRIUM** Phase, component and degree of freedom, Phase rule, Clausius - Clapeyron equation and its applications to Solid-Liquid, Liquid-Vapor and Solid-Vapor, limitations 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 MOT. **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 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.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:	**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	
Subject Expert	
Subject Expert	
Subject Expert	
Subject Expert	
Representative (Other faculty)	
Representative (Alumni/Student)	
Representative	

Departmental members:

1. Dr. Ajin D. Ulen	
2.	
3.	
4. Dr. Varsha Joshi	
5. Dr. Sunitha Mathew	
6. Dr. Prerna Kathane	
7. Dr. Neha Jha	Neha Jha
8.	
9.	
10.	

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26

Chemistry Lab Course

PART A: INTRODUCTION			
Program: **FYUP**		Class: **B.Sc.** Semester - **V**	Session: **2025-26**
1	Course Code	**BCHL -501**	
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 : **50**	Minimum Passing Marks: **20**

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 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 TB of Qualitative Analysis, 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. Experimental Physical Chemistry, R.C.Das and B. Behra, Tata McGraw Hill.

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

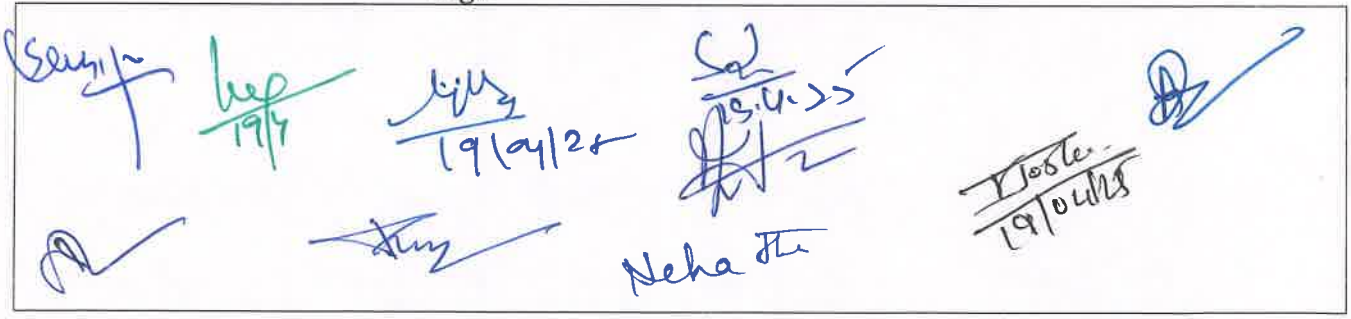
i. SWAYAM https://swayam.gov.in
ii. e-Pathshala https://epathshala.nic.in

PART D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:
Maximum Marks: 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



GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY ELECTIVE

PART A: INTRODUCTION			
Program: **FYUP**		Class: **B.Sc.** Semester - **V**	Session: **2025-26**
1	Course Code	**BCHE 502**	
2	Course Title	**DYES AND POLYMER CHEMISTRY**	
3	Course Type	**Discipline Specific Elective - I (DSE - I)**	
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 chemical constitution of dyes. • CO3: Discuss various types of polymeric materials. • CO4: Describe preparation, structure, properties and application s	
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. Polymer Science, V. R. Gwariker, N. V. Vishvanathan, Jaydev Sreedhar, New Age.
3. ATextbook of Polymer Chemistry, Dr. M.S. Bhatnagar, S. Chand Publication.
4. Dr. Vinay Prabha Sharma, Organic Chemistry, A Pragati Edition.
5. 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:

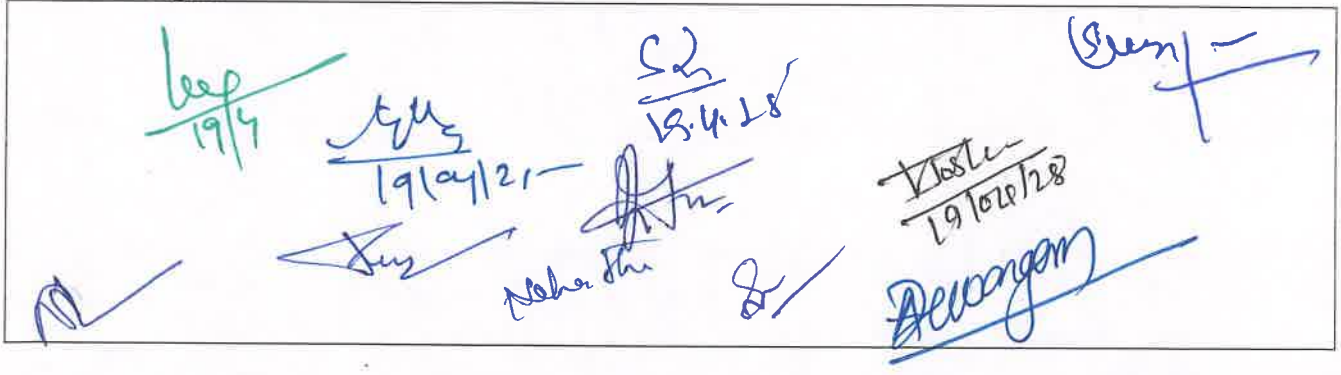
Maximum Marks: **100 Marks**

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



GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY ELECTIVE LAB COURSE

Part A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **V**		Session: **2025-26**
1	Course Code	**BCEL - 502**		
2	Course Title	**LAB COURSE ELECTIVE - 01**		
3	Course Type	**DSE - 1**		
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.		
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: 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

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY ELECTIVE

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **V**		Session: **2025-26**
1	Course Code	**BCHE 503**		
2	Course Title	**Photochemistry and Pericyclic Reactions**		
3	Course Type	**Discipline Specific Elective - II (DSE - II)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Understand photochemical reactions and mechanisms. • CO2: Explain photochemistry of alkenes and aromatic compounds. • CO3: Understand photochemistry and pericyclic reactions. • CO4: Discuss reaction mechanisms, rearrangements, and different type of pericyclic reactions.		
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	**PHOTOCHEMICAL REACTIONS AND REACTION MECHANISM** Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecules, quantum yield, transfer of excitation energy, actinometry. Classification, rate constants and life times of reactive energy states - determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. **TYPES OF PHOTOCHEMICAL REACTIONS** – Photo-oxidation, photo-reduction, photo- dissociation, gas phase photolysis.	08
II	**PHOTOCHEMISTRY OF ALKENES COMPOUNDS** Intramolecular reactions of the olefinic bond - geometrical isomerism, cyclisation reactions, photochemical rearrangement of alkenes, rearrangement 1, 4- and 1,5- dienes. **PHOTOCHEMISTRY OF AROMATIC COMPOUNDS** Photochemical isomerization of aromatic compounds, Photochemical addition and substitutions reactions shown by aromatic compounds.	10
III	**PHOTOCHEMISTRY OF CARBONYL COMPOUNDS** Photochemical reactions of carbonyl compounds: Norrish type I and II reactions Intramolecular reactions of carbonyl compounds - saturated cyclic and acyclic, β, γ - unsaturated and α, β - unsaturated compounds. Cyclohexadienones. Intermolecular cycloaddition reactions – photo-dimerisation reaction and oxetane formation.	9
IV	**MISCELLANEOUS PHOTOCHEMICAL REACTIONS** Photo-Fries reactions of anilides. Photo-Fries rearrangment. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog. Photodegradation of polymers. Photochemistry of vision.	8

V	**PERICYCLIC REACTIONS** Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3- butadiene, 1,3,5- hexatriene and allyl system. Classification of pericyclic reactions. Woodward- Hoffman correlation diagrams. FMO and PMO approach. Electrocyclic reactions- conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Cycloadditions- antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes. Sigmatropic rearrangements, suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3-and 5,5-sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangements.	**10**

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1. Singh, J. (2005). Photochemistry and pericyclic reactions. New Age International.
2. Turro, N. J., Ramamurthy, V., & Scaiano, J. C. (2010). Modern molecular photochemistry of organic molecules (Vol. Sausalito, CA: University Science Books).
3. Rohatgi-Mukherjee, K. K. (1978). Fundamentals of photochemistry. New Age
4. Sankararaman, S. . Pericyclic Reactions-A TB: Reactions, Applications and Theory. Wiley.
5. Ahluwalia, V. K. (2022). Stereochemistry of Organic Compounds. Springer.

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

https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/photchem.htm
https://microbiozindia.com/the-fundamentals-of-photochemistry-understanding-the-basics/
https://www.hhrc.ac.in/ePortal/Chemistry/I%20MSc%20Chemistry-18PCHE1-
https://teachmint.storage.googleapis.com/public/3504742876/StudyMaterial/771655fb-359b-

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

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY ELECTIVE LAB COURSE

Part A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **V**		Session: **2025-26**
1	Course Code	**BCEL - 503**		
2	Course Title	**LAB COURSE ELECTIVE - 02**		
3	Course Type	**DSE - 2**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Learn the advanced organic chemistry concept that will applied in solving their future chemistry problems. • CO2: Discuss about arenium ion ,classical versus non classical carbonium ion ,different rearrangement reactions • CO3: Make student aware the level of basic organic chemistry to apply in different reaction mechanisms and organic transformations		
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	1. Synthesis of organic compound involving important chemical reaction:- (a) Acetylations salicylic acid, aniline, glucose and hydroquinone, (b) Benzoylation of aniline and phenol. (c) Aliphatic electrophilic substitution: preparation of iodoform from ethanol and acetone (d) Arromatic electrophilic substitution: nitration-preparation of meta dinitrobenzene, p-nitroacetinalide, halogenation: preparation of p-bromoaetanilaide, 2,4,6-tribromophenol. (e) Diazotisation/ coupling :- Preparation of methyl orange and methyl red, (f) Oxidation: Preaparation of benzoic acid from toluene (g) Reduction: Preparation of aniline from nitrobenzene, m- nitroanilene from m-dinitrobenzene. 2. Isolation of some natural products(casein from milk, lycopene from tomato, nicotine from tobacco leaves etc.) 3. Detection of element, functional group and organic compound.
Note:	**Experiments may be added/ deleted subject to availability of time and facilities**

PART C: LEARNING RESOURCE
Text Books, Reference Books, Other Resources
1. Dr. O.P. Agrawal, Advanced Practical Organic Chemistry, Krishna Publication. *2.* Brian S. Furniss, Antony J.Hannaford, Peter W.G.Smith, Austin R.Tacheell. Vogel Textbook of Practical Organic Chemistry 5th edition, Pearson Publication. *3.* N K Vishnoi, Advance Practical Organic chemistry, third Edition. *4.* Dr. Bishwajit Saikia, Organic chemistry I with practical.

Online Resources– **SWAYAM** https://swayam.gov.in **e-Pathshala** https://epathshala.nic.in **Web Resources :-** **Not Voodoo** **The Safety Net**
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	.....	
Subject Expert (University Nominee)	.....	
Subject Expert	.....	
Subject Expert	.....	
Subject Expert	.....	
Representative (Industry)	.....	
Representative (Alumni)	.....	
Representative (Professor Science Faculty Other Dept.)	.....	

Departmental members:

1. Dr. Ajai Pillai .....
2. ....
3. Dr. Varsha Jose .....
4. Dr. Sunitha Mathew .....
5. Dr. P. Kothane .....
6. Dr. Neha Tha Neha Tha .....
7. Dr. Bonnalen .....
8. ....
9. ....
10. ....

DEPARTMENT OF CHEMISTRY

Four Year Undergraduate Program
Semester VI
Course Curriculum

B.Sc. CHEMISTRY
(DSC/GEC and DSE)

Session 2025-26

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY

PART A: INTRODUCTION				
Program: **FYUP**		**Class: B.Sc.**	**Semester - VI**	**Session:2025-26**
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 : **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	**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/

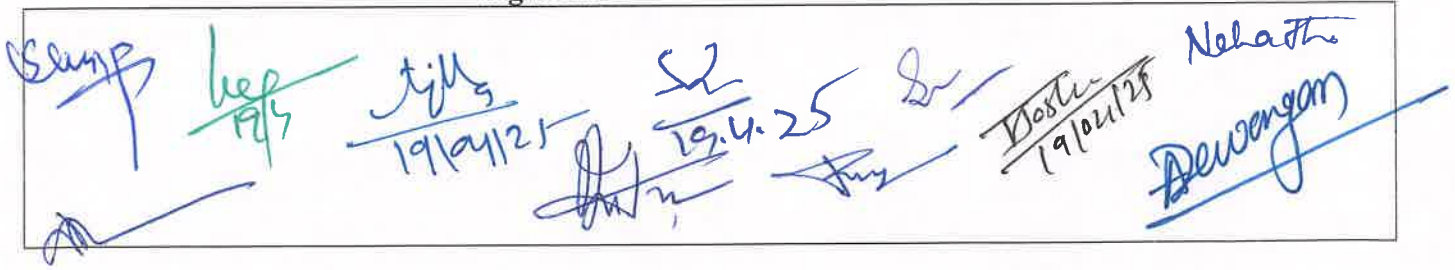
PART D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks:	**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



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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY LAB COURSE

PART A: INTRODUCTION			
Program: **FYUP**		Class: **B.Sc.** Semester - **VI**	Session: **2025-2026**
1	Course Code	**BCHL - 601**	
2	Course Title	**Lab Course -6**	
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 : **50**	Minimum Passing Marks: **20**

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 λmax values.
III	**INORGANIC CHEMISTRY** • 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)

	Inorganic Preparations: • 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: 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	Departmental members:	
Chairperson /H.O.D		1. Dr. Ajay P. Illai	
Subject Expert ..... (University Nominee)	19/4	2.	.....
Subject Expert.....	19/04/25	3. Dr. Varsha Joshi	
Subject Expert.....		4.	.....
Subject Expert.....	19.4.25	5. Dr. Sunitha Mathew	
Representative..... (Industry)		6. Dr. Praveena Kathane	
Representative..... (Alumni)		7. Dr. Neha Jha	Nehajha
Representative ..... (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 2025 -26
CHEMISTRY ELECTIVE

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VI**		Session: **2025-26**
1	Course Code	**BCHE 602**		
2	Course Title	**INSTRUMENTAL METHODS OF ANALYSIS**		
3	Course Type	**Discipline Specific Elective - I (DSE - I)**		
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.

Text Books/ Reference Books:

8. Ewing, G. W. (1975). Instrumental methods of chemical analysis. G. W. Ewing.
9. Chatwal, G., & Anand, S. (2013). Instrumental methods of analysis. Himalaya Publishing House.
10. Khopkar, S. M. (1997). Analytical chemistry: Problems and solutions. New Age International Publishers.
11. Khopkar, S. M. (2003). Basic concepts in analytical chemistry. New Age International Publishers.
12. Meites, L., & Thomas, H. C. (1977). Advanced analytical chemistry. McGraw-Hill.
13. Meites, L., & Thomas, H. C. (1990). Advance analytical chemistry: Meites and Thomas. McGraw-Hill.
14. Skoog, D. A., & West, D. M. (1976). Fundamentals of analytical chemistry.
15. Shyder, L. R., & Harvath, C. H. (1983). An introduction to separation science. Wiley Interscience.
16. Sane, S. S., & Joshi, M. V. (2011). Electroanalytical chemistry. Quest Publications.
17. 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

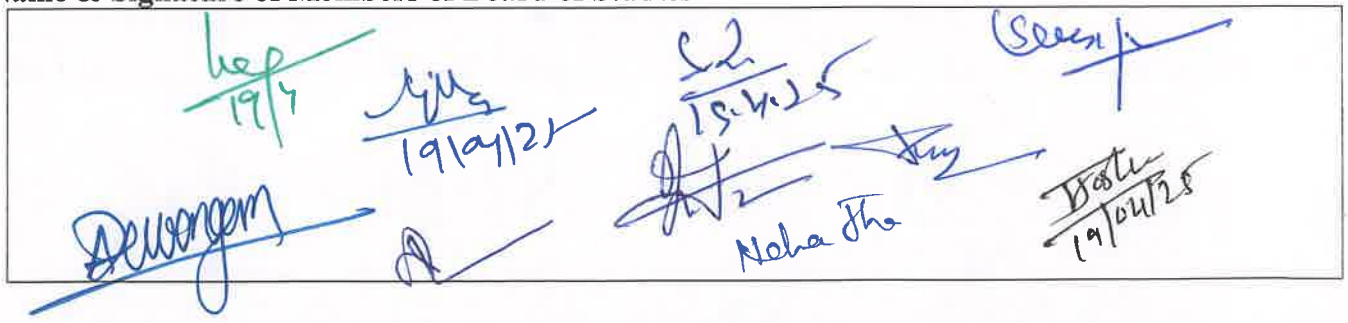
PART D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks:	**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



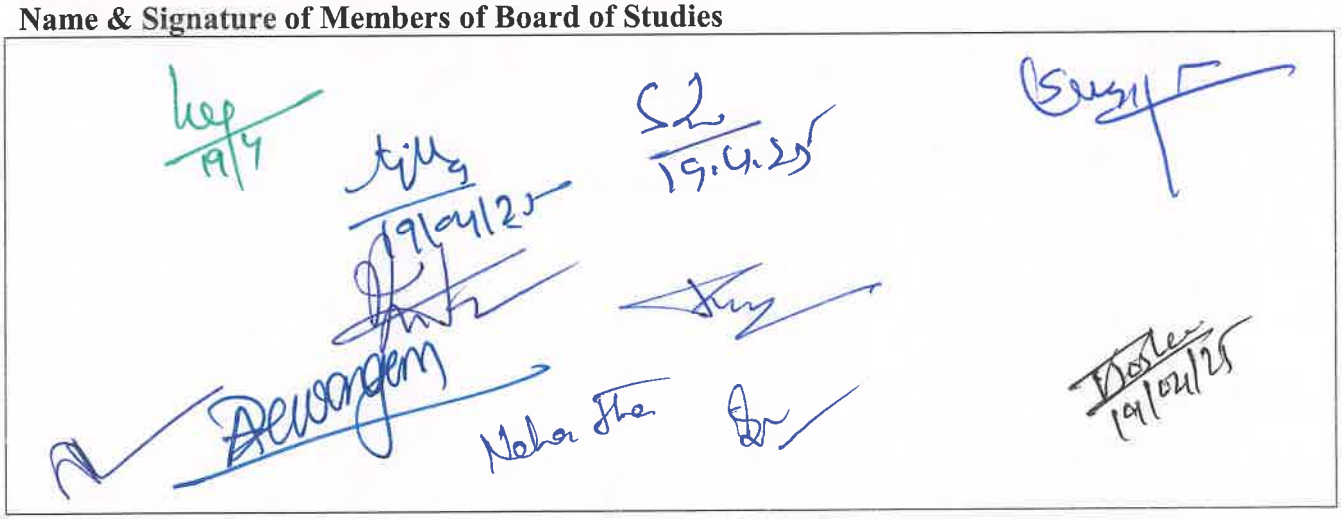
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY ELECTIVE LAB COURSE

Part A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VI**		Session: **2025-26**
1	Course Code	**BCEL - 602**		
2	Course Title	**LAB COURSE ELECTIVE - 01**		
3	Course Type	**DSE - 1**		
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: 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



GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY ELECTIVE

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VI**		Session: **2025-26**
1	Course Code	**BCHE 603**		
2	Course Title	**HETEROCYCLIC CHEMISTRY**		
3	Course Type	**Discipline Specific Elective - II (DSE - II)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Apply Hantzsch-Widman and IUPAC nomenclature for heterocyclic compounds. • CO2: Understand the concept of tautomerism in aromatic heterocycles and to analyze the influence of strain on small ring heterocycles. • CO3: Learn the synthesis and reactions of three-, four-, five- and six-membered heterocycles with one heteroatom. • CO4: Describe the synthesis of important bicyclic heterocycles (indole, quinoline, and isoquinoline) and learn the mechanisms of reactions.		
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	**NOMENCLATURE AND STEREOCHEMISTRY** Introduction to heterocyclic compounds, Trivial names of common ring systems Hantzsch-Widman nomenclature for: Monocyclic heterocycles, Fused heterocycles Bridged heterocycles Replacement of Hantzsch-Widman nomenclature by IUPAC nomenclature	9
II	**TAUTOMERISM AND STRAIN IN HETEROCYCLES** Tautomerism in aromatic heterocycles The effect of strain: Bond angle strain Torsional strain Consequences of strain in small ring heterocycles	8
III	**THREE- AND FOUR-MEMBERED HETEROCYCLES** Synthesis and reactions of: Aziridines, Oxiranes (epoxides), Thiiranes, Azetidines Oxetanes, Thietanes	8
IV	**FIVE- AND SIX-MEMBERED HETEROCYCLES WITH ONE HETEROATOM** Preparation and properties (chemical and physical) of: Pyrroles (including Paal-Knorr synthesis, Knorr pyrrole synthesis, and Hantzsch synthesis), Furan, Thiophene. Pyridine (including Hantzsch synthesis) **FIVE-MEMBERED HETEROCYCLES WITH TWO HETEROATOMS** Preparation, properties, and Substitution reactions of: Pyrazoles, Imidazoles, Oxazoles	10

V	**BICYCLIC HETEROCYCLES: REACTIONS AND SYNTHESIS** Indole (including Fischer indole synthesis and Madelung synthesis) Quinoline and isoquinoline (including Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction, Pictet- Spengler reaction, and Pomeranz-Fritsch reaction) Reactions of bicyclic heterocycles: Mechanisms of electrophilic and nucleophilic substitutions, Oxidation and reduction reactions	**10**

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1. Gupta, R.R., Kumar, M., & Gupta, V. (Eds.) Heterocyclic Chemistry (Vol. 1-3). Springer.
2. Eicher, T., & Hauptmann, S. (2003). Chemistry of Heterocycles. Thieme.
3. Newkome, G.R., & Paudler, W.W. , Contemporary Heterocyclic Chemistry. Wiley- Intersc.
4. Acheson, R.M. (1961). An Introduction to the Heterocyclic Compounds. John Wiley.
5. Katritzky, A.R., & Rees, C.W. Comprehensive Heterocyclic Chemistry. Pergamon Press.
6. Joule, J.A., Mills, K., & Smith, G.F. (2010). Heterocyclic Chemistry. Wiley-Blackwell.
7. Gilchrist, T.L. (1992). Heterocyclic Chemistry. Pearson Education Limited.

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

- https://www.masterorganicchemistry.com/
- https://docs.chemaxon.com/display/lts-helium/functions-by-categories.md
- https://archive.catalog.arizona.edu/faculty/courses/001/chem.html
- https://www.organic-chemistry.org/
- https://www.sciencedirect.com/org/journal/journal-of-heterocyclic-chemistryhttps://www.wiley.com/en-us/Heterocyclic+Chemistry%2C+5th+Edition-p-

https://www.wiley.com/en-us/Name+Reactions+in+Heterocyclic+Chemistry-p-9780471302155

PART D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

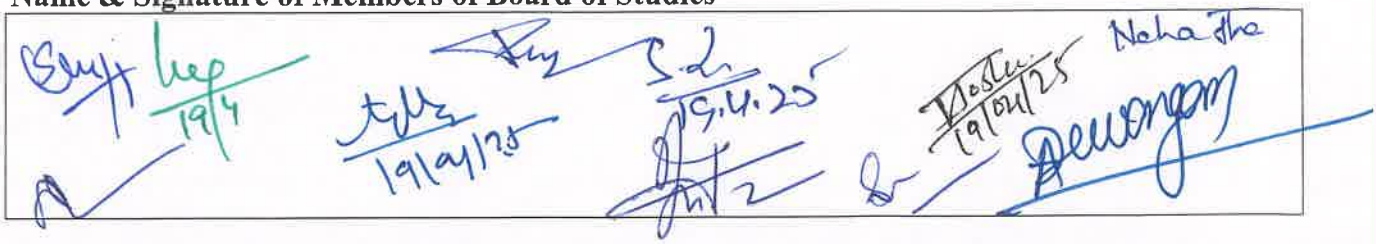
Maximum Marks: 100 Marks

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



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 - 603**		
2	Course Title	**LAB COURSE ELECTIVE - 02**		
3	Course Type	**DSE - 2**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • CO1: Understand basic laboratory techniques like distillation, extraction, crystallization, and chromatography. • CO2: Apply synthesis and purification of heterocyclic compounds. • CO3: Adept at using various spectroscopic techniques (IR, NMR, MS) to characterize heterocyclic structures. • CO4: Analyze reaction mechanisms and predict product formation in heterocyclic reactions.		
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./ Field Training / Experiment Contents of Course	**Synthesis and Characterization of a Simple Pyridine Derivative:** This experiment will involve the synthesis of a pyridine derivative (e.g., 2- aminopyridine, 2,6-dimethylpyridine(Hantzsch-syntheis) or nicotinamide) followed by purification (recrystallization/distillation) and characterization using melting point, thin-layer chromatography (TLC). **Synthesis and Characterization of a Five-Membered Heterocycle (e.g., Imidazole, Pyrazole, Furan):** Students will synthesize an 2,5 dimethyl pyrrole(Paal-Knorr synthesis) imidazole, pyrazole derivative using a condensation reaction. Purification (distillation/recrystallization) and characterization using techniques like melting point , TLC. **Synthesis and Characterization of a Benzofused Heterocycle** This experiment experiment will involve the synthesis of Coumarins, Coumarone, 2-Phenylindole, Indigo(Dye) **Isolation of Caffeine from Tea Leaves:** This practical involves the extraction and purification of caffeine (a purine derivative) from tea leaves. Techniques like solvent extraction, filtration, and sublimation might be employed. **Identification of Unknown Heterocycle:** Students will be presented with an unknown heterocyclic compound and utilize various spectroscopic techniques (IR, NMR, mass spectrometry) to identify the functional groups and propose the structure of the unknown molecule.
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	
Text Books Recommended – 1. Ahluwalia, V. K., & Aggarwal, R. (2000). Comprehensive practical organic chemistry: Preparations and quantitative analysis, Universities Press 2. Miller, J. R., & Friswell, M. D. (2000). Organic Chemistry Laboratory Techniques. Pearson Education Limited. 3. Mohrig, J., Garland, T. L., & Hammond, P. C. (2022). Techniques and Experiments in Organic Chemistry. W. H. Freeman and Company.	
Online Resources– **e-Resources / e-books and e-learning portals** (https://www.cas.org/) (https://www.youtube.com/channel/UCEWpbFLzoYGPfuWUMFPSaoA) (https://ocw.mit.edu/courses/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	.....	
Subject Expert (University Nominee)	.....	
Subject Expert	.....	
Subject Expert	.....	
Subject Expert	.....	
Representative (Industry)	.....	
Representative (Alumni)	.....	
Representative (Professor Science Faculty Other Dept.)	.....	

Departmental members:

1. Dr. Ajin Pillai .....
2. ....
3. Dr. Preema Kathane .....
4. Dr. Varsha Jadhav .....
5. Dr. Sunitha Mathew .....
6. Dr. Neha Jha .....
7. Dr. Sarayu .....
8. ....
9. ....
10. ....

DEPARTMENT OF CHEMISTRY

Four Year Undergraduate Program

Semester VII

Course Curriculum

CHEMISTRY

(DSC/GEC and DSE)

Session 2025-26

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VII**		Session: **2025-26**
1	Course Code	**BCHC - 701**		
2	Course Title	**INORGANIC 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: Learn Walsh diagram, bent rule, energetics of hybridization and MOT. CO2: Know structure of carbonyls, nitrosyls, dinitrogen and dioxygen complexes. CO3: Understand energy profile of a reaction and determination of stability constant of transition metal complexes. CO4: Know mechanism and kinetics of substitution and electron transfer reaction in complexes.		
5	Credit	**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	**STEREOCHEMISTRY AND BONDING IN MAIN GROUP COMPOUNDS** VSEPR, Walsh diagrams (tri -and penta- atomic molecules), dπ – pπ bonds, Bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules. **METAL π-LIGAND BONDING** Limitation of crystal field theory, molecular orbital theory, octahedral, tetrahedral and square planar complexes, π- bonding and molecular orbital theory.	**12**
II	**METAL π -COMPLEXES** Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding, structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand.	**10**
III	**METAL LIGAND EQUILIBRIA IN SOLUTION** Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pHmetry and spectrophotometry. Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic application of valence bond and crystal field theories.	**10**

IV	**REACTION MECHANISM OF TRANSITION METAL COMPLEXES** Kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anation reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reaction. Redox reactions, electron transfer reactions, mechanism of one electron transfer reactions, outersphere type reaction, cross reactions and Marcus-Hush theory, inner sphere type reactions.	13

PART C - LEARNING RESOURCES

Text Books, Reference Books, Other Resources

Reference Books:

1. Advanced inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes& Row.
3. Chemistry of the Elements, N.N. Greenwood and A. Earnshow, Pergamon.
4. Inorganic Electronic Spectrosocopy, A.B.P. Lever, Elsevier.
5. Magnetochemistry, R.L. Carlim, Springer Verlag.
6. Comprehensive Coordination Chem. eds., G. Wilkinson, R.D. Gillars J.A. McCleverty, Pergam
7. Modern spectroscopy, J. M. Hollas, John Wiley.
8. Applied electron spectroscopy for chemical analysis Ed. H. Windawi and F.L. Ho, Wiley Inters.
9. Mechanisms of Inorganic Reactions, Fred Basalo and Ralph G. Pearson, Wiley Eastern Pvt Ltd.

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

https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_pg/658

https://onlinecourses.nptel.ac.in/noc22_cy60/preview

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 (02 each)	04 x 4 = 16
	Question - C: Short answer type question	04 x 4 = 16
	Question - D: Long answer type question	07 x 4 = 28
		Total = 60 Marks

Name & Signature of Members of Board of Studies

Chairperson /H.O.D .....

Subject Expert .....

Subject Expert.....

Subject Expert.....

Subject Expert.....

Representatives.....

Departmental members:

Dr. Ajay Pillai

Dr. S. Mathew

Dr. P. Kathane

Dr. Varsha Joshi

Dr. Nelakshi

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26

Chemistry Lab Course

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VII**		Session: **2025-26**
1	Course Code	**BCHL -701**		
2	Course Title	**Lab Course -7A: INORGANIC CHEMISTRY**		
3	Course Type	**DSC/GEC**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** CO1: Understand the basic principles involved in separation and estimation of acidic and basic radicals in inorganic mixture. CO2: Apply the knowledge of qualitative and quantitative estimations in real sample analysis. CO3: Develop skill for synthesis of various inorganic compounds. CO4: Identify and characterize prepared compounds by spectral analysis.		
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**
1.	**MAJOR EXPERIMENTS** **Qualitative analysis** Qualitative analysis of mixture containing eight radicals including two less common metals from among the following by semi micro method. **Basic Radicals:** Ag, Pb, Hg Bi, Cu, Cd, As, Sb, Sn, Fe, Al, Cr, Zn, Mn, Co, Ni, Ba, Sr, Ca, Mg, Na, K, Ce, Th, Zr, W, Te, Ti, Mo, U, V, Be, Li, Au, Pt. **Acidic Radicals:** Carbonate, Sulphite, Sulphide, Nitrite, Nitrate, Acetate, Fluoride, Chloride, Bromide, Iodide, Sulphate, Borate, Oxalate, Phosphate, Silicate, Thiosulphate, Ferricyanide, Sulphocyanide, Chromate, Arsinate and Permanganate. **Quantitative Analysis** Separation and determination of two metal ions in ores, alloys, or mixtures in solution, one by volumetric and the other by gravimetric methods.
2,	**MINOR EXPERIMENTS** **Estimations** (a) Phosphoric acid in commercial orthophosphoric acid. (b) Boric acid in borax. (c) Ammonia in an ammonium salt. (d) Manganese dioxide in pyrolusite. (e) Available chlorine in bleaching powder. (f) Hydrogen peroxide in a commercial sample.

MINOR EXPERIMENTS

Preparations

Preparation of selected inorganic compounds and their study by I.R. Electronic spectra, Mossbauer, E.S.R. and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds. Theoretical study of structure and their identification ofsome preparations by spectral analysis

1. $VO(acac)_2$
2. $TiO(C_9H_8NO)_2 2H_2O$
3. Cis-K $[Cr(C_2O_4)_2(H_2O)_2]$
4. $Na[Cr(NH_3)_2(SCN)_4]$
5. $Mn(acac)_3$
6. $K_3[Fe(C_2O_4)_3]$
7. Prussian Blue, Turnbull's Blue.
8. $[Co(NH_3)_6][Co(NO_2)_6]$
9. Cis-$[Co(trien)(NO_2)_2]Cl.H_2O$
10. $Hg[Co(SCN)_4]$
11. $[Co(Py)_2Cl_2]$
12. $[Ni(NH_3)_6]Cl_2$
13. $Ni(DMG)_2$
14. $[Cu(NH_3)_4]SO_4.H_2O$

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.

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

https://onlinecourses.nptel.ac.in/noc21_cy27/preview

https://iscnagpur.ac.in/study_material/dept_chemistry/4.1_MIS_and_NJS_Manual_for_Inorgani

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

Chairperson /H.O.D .....

Subject Expert .....

Subject Expert.....

Subject Expert.....

Subject Expert.....

Representative.....

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Departmental members.

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GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY ELECTIVE

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VII**		Session: **2025-26**
1	Course Code	**BCHE 702**		
2	Course Title	**PHYSICAL CHEMISTRY -I**		
3	Course Type	**Discipline Specific Elective - 1 (DSE - 1)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** CO1: Solve problems based on vector, matrix algebra, probability, calculus and its application in chemistry. CO2: Explain the basic postulates of quantum mechanics and solve Schrodinger equation for quantum mechanical models. CO3: Discuss the quantum mechanical aspect of angular momentum and spin, Russell-Saunders terms and coupling schemes, atomic terms and evaluate term symbols. CO4: Describe different theories of reaction rates, fast reactions, kinetics of photochemical and unimolecular reactions.		
5	Credit Value	**3 Credit**	**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	**VECTORS, MATRIX ALGEBRA AND PROBABILITY** Vectors, dot, cross and triple products. The gradient, divergence and curl. Addition and multiplication; inverse, adjoint and transpose of matrices, special matrices (symmetric, skew-symmetric, Hermitian, skew-Hermitian, unit, diagonal, unitary) and their properties. Introduction to determinants. Permutations and combinations and probability. **CALCULUS** Rules for differentiation, applications of differential calculus including maxima and minima, partial differentiation. Basic rules for integration, integration by algebraic simplification, integration by parts, partial fraction and substitution. First-order differential equations, homogeneous, exact and linear equations.	**10**
II	**QUANTUM CHEMISTRY** Time-independent Schrodinger equation and the postulates of quantum mechanics. Discussion of solutions of the Schrodinger equation to some model systems viz. particle in one dimensional and three - dimensional box, concept of degeneracy, the harmonic oscillator, the rigid rotor, the hydrogen atom. **APPROXIMATE METHODS** The variation theorem and perturbation theory (first order and non-degenerate). Applications of variation method and perturbation theory to hydrogen and helium atom.	**13**

III	**ANGULAR MOMENTUM** Ordinary angular momentum, eigen functions and values of angular momentum, ladder operator, concept of spin, antisymmetry and Pauli's exclusion principle. **ELECTRONIC STRUCTURE OF ATOMS** Russell-Saunders terms and coupling schemes. Atomic states, atomic terms and term symbols. **MOLECULAR ORBITAL THEORY** Huckel MOT and its applications to ethylene, butadiene and cyclobutadiene.	**12**
IV	**CHEMICAL DYNAMICS** Methods of determining rate laws, Arrhenius equation, collision theory, steric factor, activated complex theory, kinetic salt effects, steady state kinetics. Photochemical reactions (Hydrogen-bromine and hydrogen - chlorine reactions), kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, flash photolysis and the nuclear magnetic resonance method. Dynamics of unimolecular reactions (Lindmann-Hinshelwood and Rice - Ramsperger- Kassel – Marcus [RRKM] theories of unimolecular reactions.	**10**

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGraw Hill
2. Quantum Chemistry, Ira N. Levine, Prentice Hall
3. Chemical Kinetics, K.J. Laidler, McGraw-Hill
4. Kinetics and Mech. of Chemical Transformation, Rajaram & Kuriacose, McMillan.
5. Mathematical Preparation for Physical Chemistry, F. Daniels, McGraw Hill.
6. Mathematics for Chemists, Bhupendra Singh.

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

+epathshala%3a+quantum+chemistry&u=a1a
https://www.bing.com/ck/a?!&&p=

PART D: ASSESSMENT AND EVALUATION

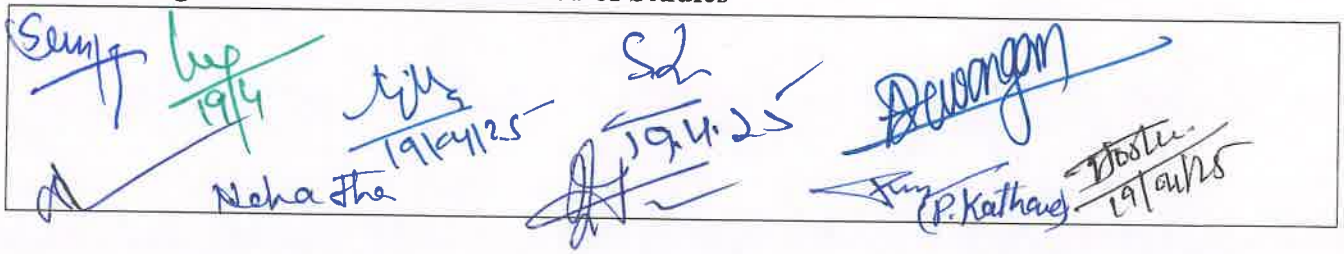
Suggested Continuous Evaluation Methods:

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 (02 each)	04 x 4 = 16
	Question - C: Short answer type question	04 x 4 = 16
	Question - D: Long answer type question	07 x 4 = 28
		Total = 60 Marks

Name & Signature of Members of Board of Studies



GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26

Chemistry Lab Course

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VII**		Session: **2025-26**
1	Course Code	**BCHL -702**		
2	Course Title	**Elective Lab Course -7B: PHYSICAL CHEMISTRY**		
3	Course Type	**DSE-1**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** CO1: Understand basic concepts in through experiential learning. CO2: Apply basic principles and handle various equipment/ instruments. CO3: Develop observation skill and analytical skill. CO4: Develop scientific temper and logical thinking.		
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**
1.	**Number of hours for each experiment: 3-4 hours** A list of experiments under different headings is given below. Experiments are to be selected **MAJOR EXPERIMENTS** **Adsorption** 1. To study surface tension – concentration relationship for solution (Gibb's equation). 2. To study the adsorption of oxalic acid on charcoal and to verify Freundlich adsorption isotherm. **Chemical Kinetics** 1. Determination of the effect of (a) Change of temperature (b) Change of concentration of reactants and catalyst and (c) ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reactions. 2. Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide studying the kinetics as an iodine clock reaction. **Polarimetry** 1. Determine the specific and molecular rotation of optically active substance. 2. To determine the concentration of a solution of an optically active substance. **Thermodynamics** 1. To determine heat of neutralization of an acid using Dewar flask. 2. To determine heat of solution of a substance by solubility method. 3. To determine the partial molar volume of solute and solvent in aqueous solutions at room temperature.
	MINOR EXPERIMENTS **Surface tension** 1. To determine surface tension of an organic liquid by drop method. 2. To compare cleansing power of detergents. 3. To study the variation of surface tension with temperature. 4. To determine the critical micelle concentration by surface tension measurements.

	Viscosity 1. To determine viscosity of an organic liquid using Ostwald viscometer. 2. To verify Kendall's equation. 3. To study the variation of viscosity with temperature. **Phase Equilibria** 1. Determination of congruent composition and temperature of a binary system (e.g. diphenylamine benzophenone system.) 2. Determination of distribution coefficient of succinic acid between ether and water. 3. To construct the phase diagram for three component system. **Solutions** 1. Determination of molecular weight of non-electrolyte/electrolyte by cryoscopic method and to determine the activity coefficient of an electrolyte. 2. Determination of molecular wt. of non-volatile substances by Landsberger's method.
2.	**Spectrophotometry** 1. Verification of Beer-Lambert law and determination of concentration of unknown solution. 2. Effect of pH in aqueous coloured system. **Conductometry** 1. To determine the basicity of an organic acid. 2. Determination of solubility and solubility product of sparingly soluble salts (e.g. $PbSO_4$, $BaSO_4$) conductometrically. 3. Determination of pK_a of acetic acid and verification of Ostwald Dilution law **Potentiometry/pH metry** 1. Determination of temperature dependence of EMF of a cell. 2. To determine pK_a of the given monobasic acid by pHmetric titration. 3. Determination of the dissociation constant of monobasic/dibasic acid by Albert-Serjeant method.

PART C - LEARNING RESOURCES

Text Books, Reference Books, Other Resources

Textbooks Recommended:

1. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
2. Findley's Practical Physical Chemistry, B.Plevitt, Longman.
3. Experimental Physical Chemistry, R.C.Das and B. Behra, Tata McGraw Hill.

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

i. https://www.bing.com/ck/a?!&&p=969a5b5b035a8a3b6282c84017d68dc936f1e

ii. https://people.iitism.ac.in/~download/lab%20manuals/chemistry_chembio/CYC

PART D: ASSESSMENT AND EVALUATION

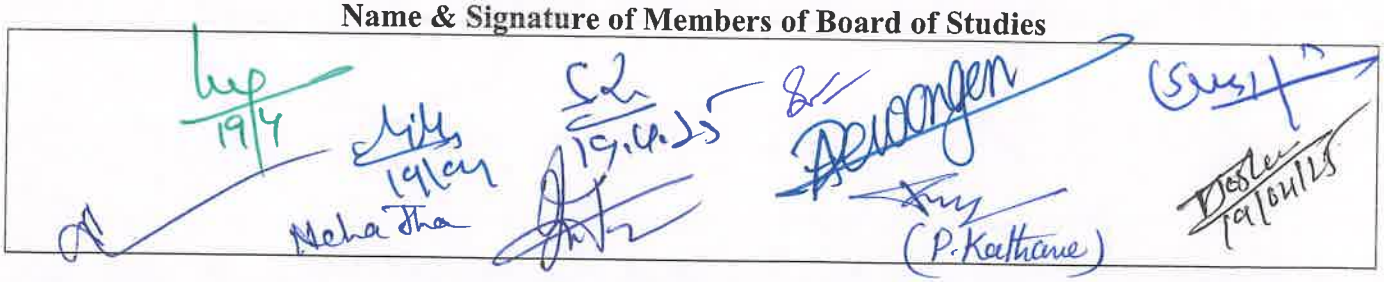
Suggested Continuous Evaluation Methods:

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



GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY ELECTIVE

PART A: INTRODUCTION			
Program: **FYUP**		Class: **B.Sc.** Semester - **VII**	Session: **2025-26**
1	Course Code	**BCHE 703**	
2	Course Title	**ORGANIC CHEMISTRY - I**	
3	Course Type	**Discipline Specific Elective -2 (DSE - 2)**	
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** CO1: Explain the basic concepts, mechanism and stereochemical aspects of elimination reactions. CO2: Describe the mechanism and stereochemistry of nucleophilic substitution reactions. CO3: Explain mechanism of electrophilic substitution in aliphatic as well as aromatic compounds. CO4: Discuss the mechanistic and stereochemical concepts of addition reactions.	
5	Credit Value	**4 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 = 60 Periods (60 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Periods
I	**REACTION MECHANISM: STRUCTURE AND REACTIVITY** Types of mechanism, types of reaction, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtin Hammett principle, potential energy diagram, transition states, intermediates, methods of determining mechanism, isotopic effects. Effect of structure on reactivity - resonance and field effects, steric effects and quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants, Taft equation. **ELIMINATION REACTIONS** The E2, E1 and E1cB mechanisms. Orientation of the double bond. Reactivity-effects of substrate structures, attacking base, the leaving group and the medium. Mechanism and orientation in pyrolytic elimination.	**15**
II	**ALIPHATIC NUCLEOPHILIC SUBSTITUTION** The S_N1, S_N2, mixed S_N1 and S_N2 and SET mechanisms. The neighbouring group mechanism, neighbouring group participation by π and σ bonds. Classical and non-classical carbocations, phenonium ions, nor-bornyl system, common carbocation rearrangements. The S_Ni mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, regioselectivity. **AROMATIC NUCLEOPHILIC SUBSTITUTION** The S_NAr, S_N1, benzyne and $S_{RN}1$ mechanisms. Reactivity - effect of substrate structure, leaving group and attacking nucleophile, The von Richter, Sommelet - Hauser and Smiles rearrangements.	**15**

III	**ALIPHATIC ELECTROPHILIC SUBSTITUTION** Bimolecular mechanisms S_E2, S_Ei and S_E1 mechanism, electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity. **AROMATIC ELECTROPHILIC SUBSTITUTION** The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, diazonium coupling, Vilsmeir reaction.	**15**
IV	**ADDITION TO CARBON – CARBON MULTIPLE BONDS** Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio- and chemoselectivity, orientation and reactivity. Hydrogenation of aromatic rings, hydrogenation of double and triple bonds. **ADDITION TO CARBON-HETERO MULTIPLE BONDS** Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds. Acids, esters and nitriles. Addition of Grignard reagent, organo zinc and organo lithium reagents to carbonyl and unsaturated carbonyl compounds, Wittig reaction. Mechanism of condensation reaction involving enolates – Claisen, Mannich, Benzoin, Perkin and Stobbe reactions.	**15**

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1. Adv. Organic Chem., Reaction Mechanism and Structure, Jerry March John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundbery, Plenum
3. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell Univ. Press.
4. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice Hall.
5. Organic Reactions and their mechanism, S. Kalsi, New Age International.
6. Reaction Mechanism in Org. Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.

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

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

Semester End Exam (SEE)	**Pattern -FOUR Questions (A, B, C, D) from each Unit**	
	Question - A & B: (Compulsory) Very short answer type (02 each)	04 x 4 = 16
	Question - C: Short answer type question	06 x 4 = 24
	Question - D: Long answer type question	10 x 4 = 40
	Total	**= 80 Marks**

Name & Signature of Members of Board of Studies

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY ELECTIVE

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VII**		Session: **2025-26**
1	Course Code	**BCHE 704**		
2	Course Title	**ANALYTICAL CHEMISTRY - I**		
3	Course Type	**Discipline Specific Elective -3 (DSE - 3)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** CO1: Derive symmetry properties of compounds, character tables and their uses in spectroscopy. CO2: Explain principles involved in interaction of electromagnetic radiation with matter. CO3: Describe the basic structure of computers, memory and operating systems and 'C' language. CO4: Develop small computer codes and programs involving simple formula in chemistry.		
5	Credit Value	**4 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 = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	**Symmetry and Group Theory in Chemistry** Symmetry elements and symmetry operation, definition of group, subgroup, relation between order of a finite group and its subgroup. Conjugacy relation and classes. point symmetry group. Schonflies symbols, representations of groups by matrices (representation for the Cn, Cnv, Cnh, Dnh etc. groups to be worked out explicitly). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their uses in spectroscopy.	**18**
II	**Unifying Principles** Electromagnetic radiation, interaction of electromagnetic radiation with matter absorption, emission, transmission, reflection, refraction, dispersion, polarization and scattering. Uncertainty relation and natural line width and natural line broadening, transition probability, results of the time dependent perturbation theory, transmission moment, selection rules, intensity of spectral lines. Born-Oppenheimer approximation, rotational, vibrational and electronic energy levels.	**12**
III	**Introduction to Computers and Computing** Basic structure and functioning of computers with a PC as an illustrative example. Memory, I/O devices. Secondary storage. Computer languages. Operating systems with DOS as an example. Introduction to UNIX and WINDOWS Data processing, principles of programming. Algorithms and flow- charts. Elements of computer language 'C'. Constants and variables. Operations and symbols. Expressions. Arithmatic assignment statement.	**12**

IV	**Computer Programming in 'C' Language** Input and Output. Format statement. Termination statements. Branching statements such as IF or GO TO statement. LOGICAL variables. Double precision variables. Subscripted variables and DIMENSION DO statement. FUNCTION and SUBROUTINE. COMMON and DATA Statements. Development of small computer codes involving simple formula in Chemistry, such as Vander Waals equation, pH titration, Kinetics, radioactive decay. Evaluation of lattice energy and ionic radii from experimental data.	**18**

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1. Computers and Common Sense, R. Hunt and J. Shelley Prentice Hall.
2. Computers Chemistry, A.C. Norris.
3. Microcomputer Quantum Mechanics, Killngbeck, Adam Hilger.
4. Computer Programming in FORTRAN IV, V Rajaraman, Prentice Hall.
5. An Introd. to Digital Computer Design. V. Rajaraman and T. Radhakrishan, Prentice Hall.
6. Physical Methods in Chemistry, R.S. Drago, Saunders College
7. Chemical Applications of Group Theory, F.A. Cotton.

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: **100 Marks**

Continuous Comprehensive Evaluation (CCE): **20 Marks**

Semester End Exam (SEE): **80 Marks**

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

Semester End Exam (SEE)	**Pattern -FOUR Questions (A, B, C, D) from each Unit**	
	Question - A & B: (Compulsory) Very short answer type (02 each)	04 x 4 = 16
	Question - C: Short answer type question	06 x 4 = 24
	Question - D: Long answer type question	10 x 4 = 40
	Total	**= 80 Marks**

Name & Signature of Members of Board of Studies

Name	Signature	Departmental members:	
Chairperson /H.O.D		Dr. Bijoy Pillai	
Subject Expert		.....	
Subject Expert.....		.....	
Subject Expert.....		Dr. Varsha Joshi	
Subject Expert.....		Dr. S. Mathur	
Representatives.....		Dr. P. Kathane	
Representative.....		Dr. Neha Jha	Neha Jha
Representative		Dr. Saroj Sen	

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY ELECTIVE

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VII**		Session: **2025-26**
1	Course Code	**BCHE 705**		
2	Course Title	**POLYMER CHEMISTRY**		
3	Course Type	**Discipline Specific Elective -4 (DSE - 4)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** CO1: Explain the mechanism of various types of polymerization and conditions in homogenous and heterogenous systems. CO2: Discuss kinetics and statistics in different kinds of polymerization. CO3: Correlate the structure and its effect on properties of polymer. CO4: Describe various polymer processing techniques, characterization, analysis and testing methods of polymers.		
5	Credit Value	**4 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 = 60 Periods (60 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Periods
I	**MECHANISM OF POLYMERIZATION** Basic concepts- Monomers, repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers. Polymerization: Mechanism of condensation polymerization, mechanism of addition polymerization – free radical chain, cationic, anionic, coordination and mechanism of copolymerization. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous systems.	12
II	**KINETICS AND STATISTICS OF POLYMERIZATION** Kinetics and statistics of stepwise polymerization – reactivity and molecular size, kinetics and statistics, molecular weight control. Kinetics of free radical chain polymerization, equation for kinetic chain length, degree of polymerization and chain transfer; Kinetics of cationic polymerization; kinetics of anionic polymerization. Kinetics of hetrogeneous polymerization using Ziegler Natta catalysts.	18
III	**STRUCTURE AND PROPERTIES** Morphology and order in crystalline polymers - configurations of polymer chains. Crystal structures of polymers. Polymer structure and physical properties- crystalline melting point T_m - melting points of homogenous series, effect of chain flexibility and other steric factors, entropy and heat of fusion. The glass transition temperature , T_g - relationship between T_m and T_g , effects of molecular weight, diluents , chemical structure, chain topology, branching and cross linking.	12

IV	**POLYMER PROCESSING** Plastics, elastomers and fibers, compounding. Processing techniques: Calendering, die casting, rotational casting, film casting, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming, reinforcing and fiber spinning. **POLYMER CHARACTERIZATION** Polymer solutions – Criteria of polymer solubility, thermodynamics of polymer solution – ideal solution, entropy, heat and free energy of mixing. Analysis and testing of polymers - chemical, analysis of polymers, spectroscopic methods, X-ray diffraction study, microscopy, thermal analysis and physical testing tensile strength. Fatigue, impact, tear resistance, hardness and abrasion resistance.	18

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1.Polymer Science, Gowarikar, Vishwanathan, Sridhar, Willey Eastern.
2.Textbook of Polymer Science, F.W. Billmeyer, Jr. Wiley
3.Contemporary Polymer Chemistry, Alcock and Lambe, Prentice Hall.
4.Physics and Chemistry of Polymers, J.M.G. Cowic, Blackie, Acad and Professional.
5.Funcitonal Monomers and Polymers, K. Takemoto, Y. Inaki and R.M. Ottanbrite.

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

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

Semester End Exam (SEE)	**Pattern -FOUR Questions (A, B, C, D) from each Unit**	
	Question - A & B: (Compulsory) Very short answer type (02 each)	04 x 4 = 16
	Question - C: Short answer type question	06 x 4 = 24
	Question - D: Long answer type question	10 x 4 = 40
	Total	**= 80 Marks**

Name & Signature of Members of Board of Studies

Chairperson /H.O.D .....
Subject Expert .....
Subject Expert.....
Subject Expert.....
Subject Expert.....
Representatives .....
Representative.....
Representative.....

Departmental members:

Dr. Ajay Pillai
Dr. P. Kathane
Dr. Soma Sen
Dr. Varsha Joshi
Dr. Neha Jha

DEPARTMENT OF CHEMISTRY

Four Year Undergraduate Program

Semester VIII

Course Curriculum

CHEMISTRY

(DSC/GEC and DSE)

Session 2025-26

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY

PART A: INTRODUCTION			
Program: **FYUP**		Class: **B.Sc.** Semester - **VIII**	Session: **2025-26**
1	Course Code	**BCHC - 801**	
2	Course Title	**ORGANIC 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: Recognize and distinguish between aromatic and antiaromatic compounds by their structures. CO2: Explain different free radicals and mechanisms of different rearrangements via free radicals. CO3: Learn the terminology associated with conformational analysis and stereochemistry of various compounds CO4: Know the basic concept of different types of pericyclic reactions and rules governing them.	
5		**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	**NATURE OF BONDING IN ORGANIC MOLECULES** Localized and delocalized chemical bond, conjugation and cross conjugation, bonding in fullerenes, Bonds weaker than covalent-addition compounds, crown ether complexes and cryptands, inclusion compounds, cyclodextrins, catenanes and rotaxanes **AROMATICITY** Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons, Huckel's rule, energy level of pi-molecular orbitals, annulenes, antiaromaticity, homo-aromaticity, PMO approach.	12
II	**FREE RADICAL REACTIONS** Types of free radical reactions, free radical substitution mechanism at aromatic substrate, neighboring group assistance. Reactivity for aliphatic and aromatic substrates at bridgehead. Reactivity in the attacking radicals. Effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes, arylation of aromatic compound by diazonium salts, Sandmeyer reaction. Free radical rearrangement, Hunsdiecker reaction.	10
III	**CONFORMATIONAL ANALYSIS** Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity, conformation of sugars, steric strain due to unavoidable crowding. **STEREOCHEMISTRY** Elements of symmetry, chirality, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselective synthesis. Asymmetric synthesis. Optical	

	activity in the absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.	**10**
IV	**PERICYCLIC REACTIONS** Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3- butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffman correlation diagrams. FMO and PMO approach. Electrocyclic reactions-conrotarory and disrotatory motions, 4n, 4n+2 and allyl systems. Cycloadditions-antarafacialand suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes.Sigmatropic rearrangements, suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3, 3-and 5,5- sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangements.	**13**

PART C - LEARNING RESOURCES

Text Books, Reference Books, Other Resources

Reference Books:

1. Advanced Organic Chemistry – Reaction Mechanism and Structure, Jerry March John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundbery, Plenum
3. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.
4. Pericyclic reactions, S.M. Mukherji, Macmillan India.
5. Reaction Mechanism in Org. Chem., S.M. Mukherji and S.P. Singh, Macmillan.
6. Stereo Chemistry of Organic Compounds, D. Nasipuri, New Age International.
7. Stereo Chemistry of Organic Compounds, P.S. Kalsi, New Age International.
8. Organic Chemistry, I.L.Finar, Vol. I & II,ELBS.

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

https://onlinecourses.swayam
https://onlinecourses.nptel.ac.in

PART D: ASSESSMENT AND EVALUATION

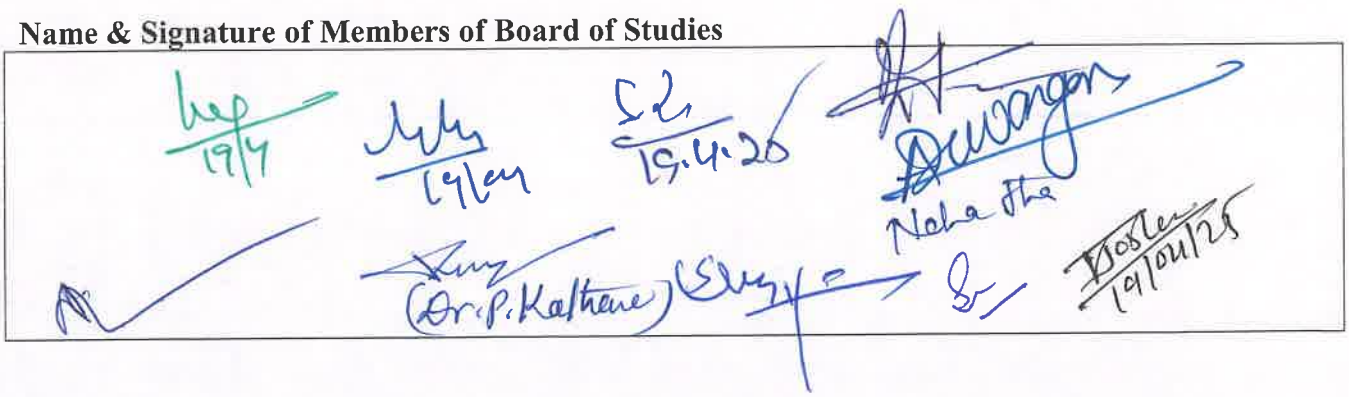
Suggested Continuous Evaluation Methods:

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 (02 each)	04 x 4 = 16
	Question - C: Short answer type question	04 x 4 = 16
	Question - D: Long answer type question	07 x 4 = 28
		Total = 60 Marks

Name & Signature of Members of Board of Studies



GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26

Chemistry Lab Course

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VIII**		Session: **2025-26**
1	Course Code	**BCHL -801**		
2	Course Title	**Lab Course -8A: ORGANIC CHEMISTRY**		
3	Course Type	**DSC/GEC**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** CO1: To understand the basic principles involved in separation of organic binary mixture and identify the components by qualitative analysis. CO2: To get trained in one step/two-step synthesis of commercially important organic compounds based on different chemical processes. CO3: To learn about separation and purification of organic mixtures by chromatography. CO4: To identify and characterize prepared and separated compounds by IR spectral analysis.		
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**
1.	**MAJOR EXPERIMENTS** **Organic Synthesis** (i) Acetylation: Acetylation of cholesterol and separation of cholesteryl acetate by column chromatography. (ii) Synthesis of β-Naphthyl acetate / Hydroquinone diacetate. (iii) Oxidation: Adipic acid by chromic acid oxidation of cyclohexanol (iv) Grignard reaction: Synthesis of triphenylmethanol from benzoic acid (v) Aldol condensation: Dibenzalacetone from benzyldehyde (vi) Sandmeyer reaction: p-chlorotoluene from p-toluidine / o- chlorobenzoic acid from anthranilic acid. (vii) Acetoacetic ester Condensation: Synthesis of ethyl-n-butylacetoacetate by A.E.E. condensation. (viii) Cannizzaro reaction: 4- chlorobenzaldehyde as substrate / Benzoic acid and benzyl alcohol. (ix) Friedel Crafts Reaction: β-Benzoyl propionic acid from succinic anhydride and benzene. (x) Aromatic electrophilic substitutions: Synthesis of p-nitroaniline and bromoaniline. (xi) Clemmenson reduction: Hydrocarbons from ketones. (xii) Nitration: Picric acid from phenol **Microwave assisted Synthesis** (xiii) Synthesis of benzoic acid from benzamide. (xiv) Synthesis of N-aryl Phthalimides. The products may be characterized by spectral techniques.

2.	**MINOR EXPERIMENTS** **Qualitative Analysis** Separation, purification and identification of compounds of binary mixtures (solid-solid, liquid-solid) using chemical tests. Identification of functional group of organic compounds by FTIR Separation, purification and identification of compounds of binary mixtures TLC and column chromatography. **Organic Synthesis** (i) Reduction: Acetic acid from ethanol. (ii) Esterification: Oil of Wintergreen from salicylic acid. (iii) Sulphonation: Sulphanilic acid from aniline.

PART C - LEARNING RESOURCES

Text Books, Reference Books, Other Resources

Textbooks Recommended:

1. Practical Organic Chemistry by A.I. Vogel.
2. Practical Organic Chemistry by Mann and Saunders.
3. Practical Organic Chemistry by Garg and Salija.

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. Ajai Pillai	
Subject Expert ..... (University Nominee)	19/4	2.	.....
Subject Expert.....	19/4	3.	.....
Subject Expert.....	19.4.25	4. Dr. P. Kathane	
Subject Expert.....		5. Dr. S. Mahtan	
Representative..... (Industry)		6. Dr. Varsha Joshi	
Representative..... (Alumni)		7. Dr. Nehastha	
Representative ..... (Professor Science Faculty Other Dept.)		8. Dr. Sorensen	
		9.....	.....
		10.	.....

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM 2025-26
CHEMISTRY ELECTIVE

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VIII**		Session: **2025-26**
1	Course Code	**BCHE 802**		
2	Course Title	**ANALYTICAL CHEMISTRY - II**		
3	Course Type	**Discipline Specific Elective - 1 (DSE - 1)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** **CO1:** Explain the basic principle of molecular spectra, energy levels of rigid rotor, origin of rotational spectra and its applications. **CO2:** Discuss the theories/principles of IR spectrum, predict the functional groups and differentiate between IR and Raman spectra **CO3:** Acquire knowledge of principle, technique, interpretation and applications of NMR spectroscopy. **CO4:** Interpret the principle and applications of photo electron, photo acoustic and ESR spectroscopy.		
5	Credit Value	**3 Credit**	**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	**MOLECULAR SPECTROSCOPY** Energy levels, molecular orbital, vibronic transitions, vibration progressions and geometry of the excited states, Franck - Condon principle, electronic spectra of polyatomic molecules. Emission spectra: radiative and non-radiative decay, internal conversion, spectra of transition metal complex, charge transfer spectra.	10
II	**MICROWAVE SPECTROSCOPY** Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field. Applications.	10
III	**NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY** Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift, deshielding, spin- spin interactions, factors including coupling constant 'J'. Classification (ABX, AMX, ABC, AB etc), spin decoupling. Basic ideas about instruments, FT NMR, advantages of FT NMR, use of NMR in medical diagnostics. **NUCLEAR QUADRUPLE RESONANCE SPECTROSCOPY** Quadruple nuclei, Quadruple moments, electric field gradient, coupling constant, splitting, applications.	12

IV	**PHOTOELECTRON SPECTROSCOPY** Basic principle: photo-electric effect, ionization process, Koopmans theorem, photoelectron spectra of simple molecules, ESCA, chemical information from ESCA. **PHOTO ACOUSTIC SPECTROSCOPY** Basic principles of photo acoustic spectroscopy (PAS), PAS gases and condensed systems, chemical and surface applications. **ELECTRON SPIN RESONANCE SPECTROSCOPY** Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and McConnell relationship, measurement techniques, applications.	13

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1. Modern Spectroscopy J.M. Hollas, Johan Wiley.
2. Applied Electron Spectroscopy for chemical analysis ed. H.Windawi and F.L.Ho, Wiley Intersc.
3. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorg. Chem., R.V. Parish. Ellish Harwood.
4. Physical Methods in Chemistry, R.S. Drago, Saunders Company
5. Infrared and Raman Spectra: Inorganic and Coordination Compounds, K.Nakamoto,Wiley.
6. Spectroscopic Methods in Organic Chemistry, D.H.Williams, I.Fleming, Tata McGraw- Hill.
7. Application of Spectroscopy of Organic Compounds, J .R. Dyer, Prentice Hall.

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 (02 each)	04 x 4 = 16
	Question - C: Short answer type question	04 x 4 = 16
	Question - D: Long answer type question	07 x 4 = 28
		Total = 60 Marks

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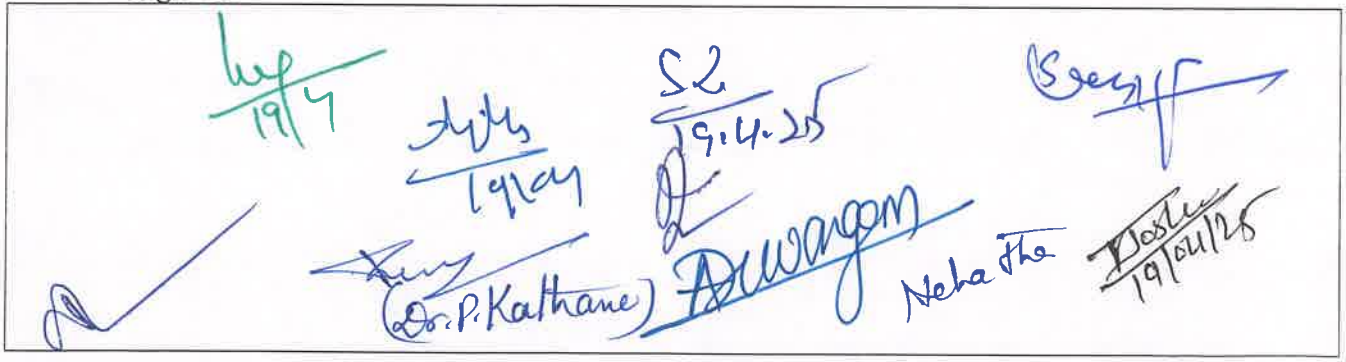

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Chemistry Lab Course

PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VIII**		Session: **2025-26**
1	Course Code	**BCHL -802**		
2	Course Title	**Elective Lab Course -8B: ANALYTICAL CHEMISTRY**		
3	Course Type	**DSE-1**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** CO1: Calibrate glassware and calculate errors CO2: Understand the basics of qualitative and quantitative analysis CO3: Apply the principles in analysis of various parameters CO4: Handle instruments and perform experiments using it		
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**
1.	**MAJOR EXPERIMENTS** **1. Error Analysis & Statistical Data Analysis** Statistical treatment for error analysis, standard deviation, linear least squares. Calibration of volumetric apparatus, burettes, pipette, standard flask, weight box, etc. **2. Volumetric Analysis** Determination of iodine and saponification values of oil sample. Determination of DO, COD, BOD of water sample. Determination of hardness of water samples. **3. Chromatography** Separation of cations and anions by Paper chromatography Column chromatography **4. Flame Photometry** Determination of sodium and potassium by flame photometer **5. Spectrophotometry** Determination of metal ions eg. Fe, Cu, Zn, Pb, etc. using inorganic reagent like SCN, an organic chelating agent like dithizone, cupferron, 8-hydroxyquinoline, etc. in aqueous / organic phase in the presence of surface active agents. **6. Nephelometry / Turbidimetry** Determination of chloride, sulphate, phosphate, etc. Determination of turbidity in water samples.

2.	**MINOR EXPERIMENTS** **1. Conductometry** Estimation of aspirin from tablet. Determination of relative strengths of different acids. Determination of the strength of strong and weak acids in a given mixture conductometrically. **2. pH metry** Determination of the strength of acid pHmetrically. Determination of strength of strong and weak acids in a given mixture using a pH meter. **3. Food Analysis** Determination of phosphate concentration in soft drinks. Detection of adulterants in food samples. **4. Water analysis** Determination of pH and conductivity of water samples. Determination of TDS in water sample. Determination of fluoride in water sample. **5. Soil Analysis** Determination of iron in soil samples. Determination of Nitrate – N in soil samples. **6. Use of Computer program and Softwares** Application of computer and softwares in Chemistry.

PART C - LEARNING RESOURCES

Text Books, Reference Books, Other Resources

Textbooks Recommended:

1. Instrumental Methods of Analysis, Skoog and West
2. Analytical Chemistry, G. D. Christian
3. Computer and Common Sense, R. Hunt and J. Shelley, Prentice Hall.
4. Computational Chemistry, A.C. Norris.
5. Computer Programming in FORTRAN IV, V. Rajaraman, Prentice Hall.

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

iii. SWAYAM https://swayam.gov.in
iv. 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)**

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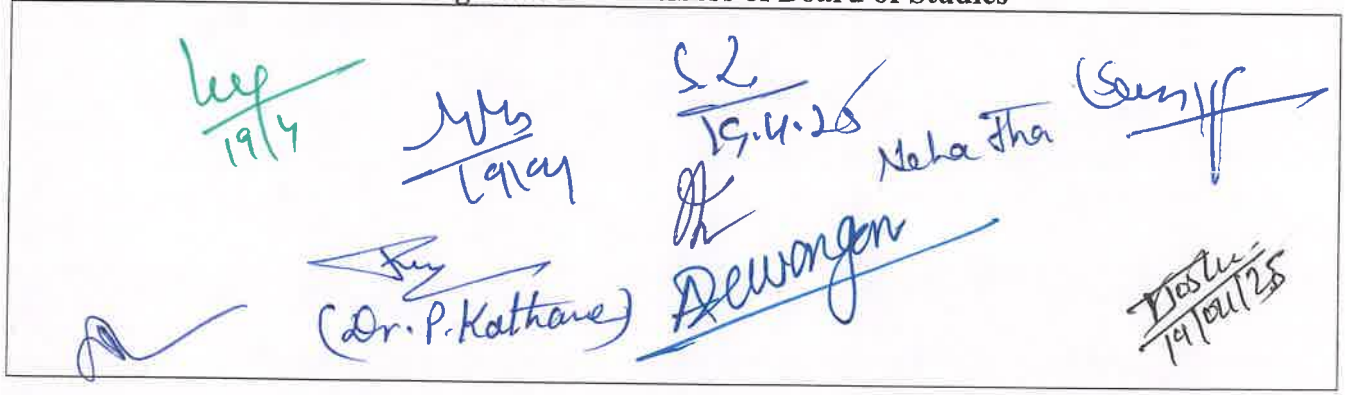

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PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VIII**		Session: **2025-26**
1	Course Code	**BCHE 803**		
2	Course Title	**INORGANIC CHEMISTRY - II**		
3	Course Type	**Discipline Specific Elective -2 (DSE - 2)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** CO1: Interpret electronic spectra of complexes. CO2: Know magnetic properties of complexes of different geometry. CO3: Explain principle and uses of electron- and x-ray diffraction methods. CO4: Describe neutron diffraction, metal cluster and metal polyacids.		
5	Credit Value	**4 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 = 60 Periods (60 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Periods
I	**ELECTRONIC SPECTRA OF TRANSITION METAL COMPLEXES** Spectroscopic ground states, correlation, Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1-d^9 states), calculations of Dq, B and parameters, charge transfer spectra, spectroscopic method of assignment of absolute configuration in optically active metal chelates and their stereochemical information.	15
II	**MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES** Magnetic properties of octahedral, tetrahedral, tetragonally distorted square planar, trigonal bipyramidal and square bipyramidal complexes based on CFT, spin equilibrium, spin free and spin paired equlibria , quenching of orbital angular momentum by ligand field, Magnetic properties of complexes with A, E and T terms, spin orbit coupling.	15
III	**X-RAY DIFFRACTION** Bragg condition, Miller indices, Laue method, Bragg method, Debye – Scherrer method of X-Ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern. Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules, Ramchandran Diagram. **ELECTRON DIFFRACTION** Scattering intensity vs scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surfaces.	15

IV	**NEUTRON DIFFRACTION** Scattering of neutrons by solid and liquids, magnetic scattering, measurement techniques. Elucidation of structure of magnetically ordered unit cell. **METAL CLUSTERS** Higher boranes, carboranes, metalloboranes and metallocarboranes. Metal carbonyl and halide clusters, compounds with metal-metal multiple bonds. **ISOPOLY AND HETEROPOLY ACIDS AND SALTS** Prepration, properties and structure of isopolyandheteropoly acids of molybdenum and tungsten.	**15**

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huheey, Harpes & Row.
3. Chemistry of the Elements, N.N. Greenwood and A. Earnshow, Pergamon.
4. Inorganic Electronic Spectrosocopy, A.B.P. Lever, Elsevier.
5. Magnetochemistry, R.L. Carlin, Springer Verlag.
6. Comprehensive Coordination Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon.
7. Modern spectroscopy, J. M. Hollas, John Wiley.
8. Applied electron spectroscopy for chemical analysis Ed. H.Windawi and F.L.Ho, Wiley.

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

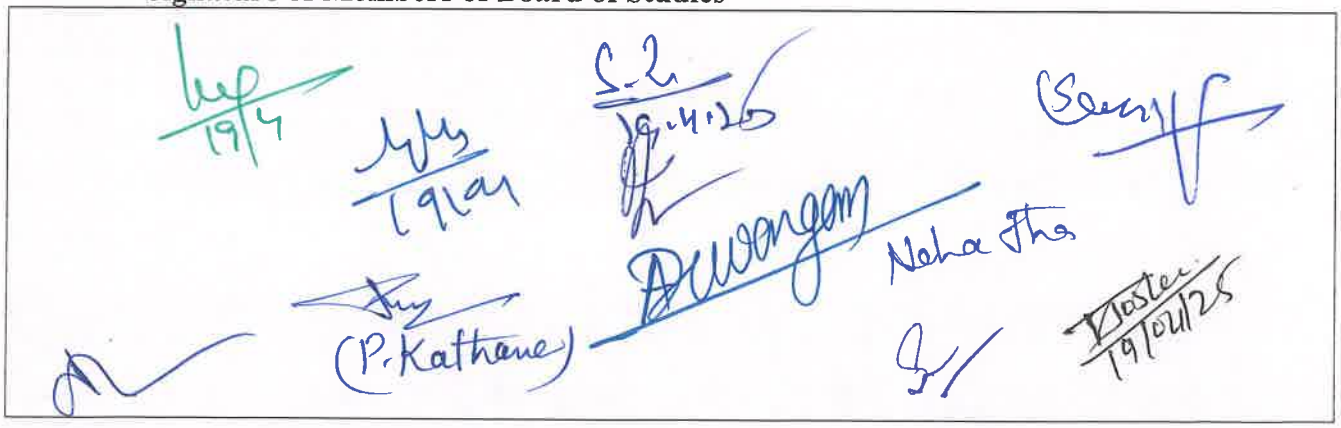
Suggested Continuous Evaluation Methods:

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

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

Semester End Exam (SEE)	**Pattern -FOUR Questions (A, B, C, D) from each Unit**	
	Question - A & B: (Compulsory) Very short answer type (02 each)	04 x 4 = 16
	Question - C: Short answer type question	06 x 4 = 24
	Question - D: Long answer type question	10 x 4 = 40
	Total	**= 80 Marks**

Name & Signature of Members of Board of Studies



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PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VIII**		Session: **2025-26**
1	Course Code	**BCHE 804**		
2	Course Title	**PHYSICAL CHEMISTRY - II**		
3	Course Type	**Discipline Specific Elective -3 (DSE - 3)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** **CO1:** Explain partial molar properties, fugacity, activity and activity coefficient, and apply phase diagrams to 3-component systems. **CO2:** Discuss concepts in statistical and irreversible thermodynamics – distribution, thermodynamic probability, partition function and its application and compare various statistics. **CO3:** Derive equations related to the theory of strong electrolytes – Debye-Huckel law and its extensions, structure/models and thermodynamics of electrified interfaces, polarography and its applications. **CO4:** Describe various adsorption isotherms and its applications, concept and various aspects of micelles and macromolecules.		
5	Credit Value	**4 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 = 60 Periods (60 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Periods
I	**CLASSICAL THERMODYNAMICS** Maxwell relations, Partial molar properties- concept, its significance and methods of determination, Concept of chemical Potential, Gibbs Duhem Equation, variation of chemical potential with temperature and pressure. Concept of fugacity, its significance and methods of determination. Non-ideal systems: excess functions for non-ideal solutions. Concept of activity and activity coefficient. Application of phase rule to three component systems: solid-liquid system and liquid-liquid system, salting out effect.	**16**
II	**STATISTICAL THERMODYNAMICS** Concept of distribution, thermodynamic probability and most probable distribution. Maxwell Boltzmann distribution, Partition functions - translational, rotational, vibrational and electronic partition functions, calculation of thermodynamic properties in terms of partition functions. Applications of partitions functions, Fermi-Dirac statistics, Bose-Einstein statistics- distribution law. **NON-EQUILIBRIUM THERMODYNAMICS** Fundamental concepts, entropy production and entropy flow, phenomenological laws, Onsager's reciprocity relations, and irreversible thermodynamics for coupled reactions.	**16**

III	**ELECTROCHEMISTRY** Electrochemistry of solutions: Ion- solvent interactions, Debye-Huckel theory for activity coefficient of electrolyte solutions, ionic strength, Debye-Huckel limiting law, Debye- Huckel- Onsager treatment and its extension. Thermodynamics of electrified interface: Derivation of electro-capillarity, Lippmann equations, determination of surface excess. Structure of electrified interfaces: Guoy-Chapman and Stern models. Over potentials, exchange current density, Butler-Volmer equation. Tafel plot. Polarography theory-Ilkovic equation, half wave potential and its significance.	**12**
IV	**SURFACE CHEMISTRY** Surface tension, capillary action, pressure difference across curved surface (Laplace equation), Gibbs adsorption isotherm, BET equation and estimation of surface area using BET equation. **MICELLES** Surface active agents, classification of surface active agents, micellization, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization, reverse micelles. **MACROMOLECULES** Polymer: definition, types of polymers, free radical mechanism of polymerization, molecular mass, number and mass average molecular mass, molecular mass determination (osmometry, viscometry and sedimentation).	**16**

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1. Thermodynamics, S.Glasstone
2. Chemical Thermodynamics, Rastogi & Mishra
3. Micelles, Theoretical and Applied Aspects, V. Moroi, Plenum
4. Modem Electrochemistry Vol.-I and Vol.-II, J.O.M. Bockris and A.K.N.Reddy, Plenum
5. Introduction to Polymer Science, V.R. Gowarikar, N.V. Vishwanamanand, J. Sridhar, Wiley.

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

SWAYAM https://swayam.gov.in

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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 of 20 Marks and Assignment of 20 Marks

Semester End Exam (SEE)	**Pattern -FOUR Questions (A, B, C, D) from each Unit**	
	Question - A & B: (Compulsory) Very short answer type (02 each)	04 x 4 = 16
	Question - C: Short answer type question	06 x 4 = 24
	Question - D: Long answer type question	10 x 4 = 40
	Total	**= 80 Marks**

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PART A: INTRODUCTION				
Program: **FYUP**		Class: **B.Sc.** Semester - **VIII**		Session: **2025-26**
1	Course Code	**BCHE 805**		
2	Course Title	**NANOMATERIALS & NANOTECHNOLOGY**		
3	Course Type	**Discipline Specific Elective -4 (DSE - 4)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** **CO1:** Discuss basic concepts in nanotechnology, nanoscale, nano-dimension and properties. **CO2:** Explain the preparation, characteristics and uses of nanomaterials **CO3:** Describe instrumentation/principle of DLS, FTIR, SEM, TEM, AFM etc and its application. **CO4:** Discuss the various applications of nanomaterials especially in the field of biology.		
5	Credit Value	**4 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 = 60 Periods (60 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Periods
I	**INTRODUCTION TO NANOTECHNOLOGY** Introduction of nanotechnology, classification of nanostructures, nanoscale architecture, Summary of the electronic properties of atoms and solids, isolated atom, bonding between atoms, giant molecular solids, free electron model and energy bands, crystalline solids, periodicity of crystal lattices, electronic conduction, effects of the nanometre length scale, changes to the system total energy, Changes to the system structure, nanoscale dimensions and properties.	12
II	**NANOMATERIALS** Preparation and properties of nanoparticles, materials-metals, ceramics (oxide, carbides, sulphides, nitrides). Physical and chemical Methods, size and shape controlled synthesis, sol-gel methods, optical Properties, electrical and magnetic properties, application of nanoparticles.	14
III	**CHARACTERIZATION METHODS OF NANOMATERIALS** X-ray diffraction, Debye-Scherer formula, dislocation density, micro strain, synchrotron Radiation, principle and applications, Raman spectroscopy and its applications, dynamic light scattering (DLS). Electron microscopes: scanning electron microscope (SEM), transmission electron microscope (TEM), atomic force microscope (AFM), scanning tunneling microscope (STM), XPS, working principle, instrumentation and applications. Differential scanning calorimeter (DSC), Thermogravimetric/Diffferential Thermal Analyzer (TG/DTA), UV – Visible Spectrophotometer, FTIR, principle and applications, photoluminescence (PL) spectroscopy.	18

IV	**APPLICATIONS OF NANOMATERIALS/NANOTECHNOLOGY** Nanobiology, bio-inspired nanomaterials, interaction between biomolecules and nanoparticles surfaces, different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies, applications of nano in biology, nanoprobes for analytical applications, current status of nanobiotechnology, future perspectives of nanobiology; nanosensors, electrochemical, nanobiosensors, smart dust; nanomedicines, nanodrug administration diagnostic and therapeutic applications.	**16**

Part C: LEARNING RESOURCE

Text Books, Reference Books, Other Resources

Text Books/ Reference Books:

1. Nanoparticles: From Theory to Application Edited by Gu¨nter Schmid, 2004 Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim
2. Nanoparticles and Catalysis Edited by Didier Astruc, 2008 Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim
3. Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong, Mike Hagerman Shriver and Atkin's Inorganic Chemistry, Fifth Edition, Oxford, 2010.
4. Nanoscale Science and Technology, Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan, John Wiley & Sons, Ltd., UK, 2005.
5. Introduction to Nanotechnology, Charles P. Poole Jr and Frank J. Owens, Wiley Intersc, 2003.
6. Nano: The Essentials: Understanding Nanoscience and Nanotecnology, T. Pradeep, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.

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

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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 of 20 Marks and Assignment of 20 Marks

Semester End Exam (SEE)	**Pattern -FOUR Questions (A, B, C, D) from each Unit**	
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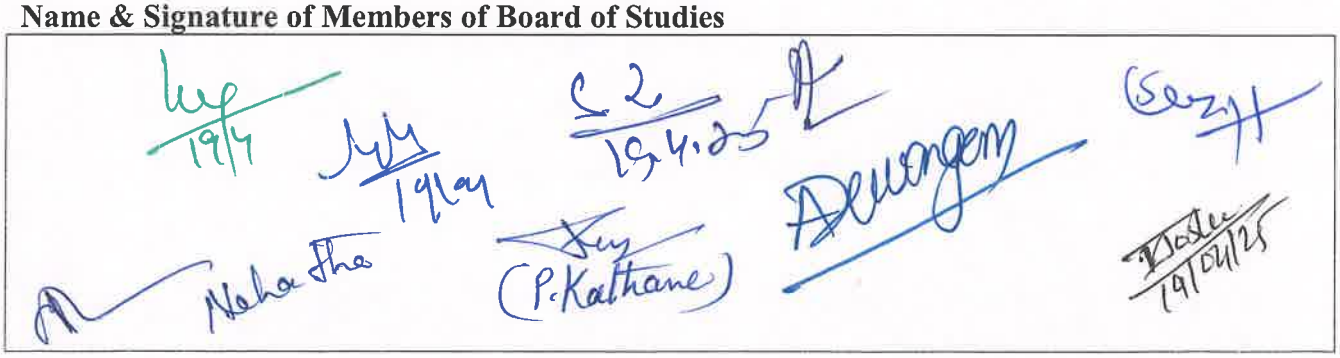
	Question - D: Long answer type question	10 x 4 = 40
	Total	**= 80 Marks**

Name & Signature of Members of Board of Studies



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The NEP Course Curriculum & Marking Scheme for FYUP (Chemistry) Semester – V, VI, VII & VIII is hereby approved by members of Board of Studies for the Session 2025-26.

NAME AND SIGNATURE:

Name	Signature
Chairperson /H.O.D	.....
Subject Expert (University Nominee)	.....
Subject Expert	.....
Subject Expert	.....
Subject Expert	.....
Representative (Industry)	.....
Representative (Alumni)	.....
Representative (Professor Science Faculty Other Dept.)	.....

Departmental members:	
1. Dr. Ajai P. Illai	.....
2.	.....
3.	.....
4. Dr. P. Kathane	.....
5. Dr. S. Mathew	.....
6. Dr. Varsha Joslei	.....
7. Dr. Neha Jha	.....
8.	.....
9.	.....
10.	.....