K. C. E. Society's
Moolji Jaitha College
An 'Autonomous College' Affiliated to
K.B.C. North Maharashtra University, Jalgaon.
NAAC Reaccredited Grade - A (CGPA : 3.15 - 3rd Cycle)
UGC honoured "College of Excellence" (2014-2019)
DST(FIST) Assisted College

KNOWLEDGE IS POWER
ESTD. 1945

के. सी. ई. सोसायटीचे
मूळजी जेठा महाविद्यालय
क.ब.चौ. उत्तर महाराष्ट्र विद्यापीठ, जळगाव संलग्नित
'स्वायत्त महाविद्यालय'
नॅकद्वारा पुनर्मानांकित श्रेणी – 'ए' (सी.जी.पी.ए. : ३.१५ – तिसरी फेरी)
विद्यापीठ अनुदान आयोगाद्वारा घोषित 'कॉलेज ऑफ एक्सलन्स' (२०१४-२०१९)
डी.एस.टी. (फीस्ट) अंतर्गत अर्थसहाय्य प्राप्त

Date :- 01/08/2024

NOTIFICATION

Sub :- CBCS Syllabi of B. Sc. in Chemistry (Sem. III & IV)

Ref. :- Decision of the Academic Council at its meeting held on 27/07/2024.

The Syllabi of B. Sc. in Chemistry (Third and Fourth Semesters) as per **NATIONAL EDUCATION POLICY – 2020 (2023 Pattern)** and approved by the Academic Council as referred above are hereby notified for implementation with effect from the academic year 2024-25.

Copy of the Syllabi Shall be downloaded from the College Website (www.kcesmjcollege.in)

Sd/-
Chairman,
Board of Studies

To :

1) The Head of the Dept., M. J. College, Jalgaon.
2) The office of the COE, M. J. College, Jalgaon.
3) The office of the Registrar, M. J. College, Jalgaon.

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समर्थ कॉलनी जवळ, जळगांव – ४२५ ००२. (महाराष्ट्र, भारत) । दूरध्वनी क्र. : +९१ २५७–२२३७३६३, २२३४२८१ । ई–मेलः mjcollege@kces.in । वेबसाईटः mjcollege.kces.in

Khandesh College Education Society's

Moolji Jaitha College, Jalgaon

An "Autonomous College" Affiliated to KBC North Maharashtra University, Jalgaon

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ESTD. 1945

STRUCTURE AND SYLLABUS

B.Sc. Honours/Honors with Research

(S.Y.B.Sc. CHEMISTRY)

Under Choice Based Credit System (CBCS)

and

as per NEP-2020 Guidelines

[w.e.f. AcademicYear:2024-25]

Preface

The core objective of Khandesh College Education Society is to prepare their students for the society. The Moolji Jaitha College (Autonomous), Jalgaon, envisions all its programmes in the best interest of their students and in this endeavour; it offers a new vision to all its Under-Graduate courses. It imbibes the guidelines of UGC, NEP-2020 and Government of Maharashtra for all its Under Graduate programmes. The Board of Study in Chemistry of the college prepared the syllabus for the first year undergraduate of Chemistry. The new curriculum of B. Sc. (Three Year Bachelor's Degree) Chemistry and B. Sc. (Four Year Bachelor's Degree – Honours / Honours with Research) Chemistry offer courses in the areas of Physical Chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry, Polymer Chemistry, Industrial Chemistry, Green Chemistry, Nanoscience and Nanotechnology etc. All the courses are having defined objectives and Course Outcomes, which will help prospective students in choosing the elective courses to broaden their skills in the field of chemistry and interdisciplinary areas. The courses will train students with sound theoretical and experimental knowledge that suits the need of academics and industry. The courses also offer ample skills to pursue research as career in the field of chemistry and allied areas.

Program Outcomes (PO) for B.Sc. Program:

Program outcomes associated with a B.Sc. degree are as follows:

1. Graduates should have a comprehensive knowledge and understanding of the fundamental principles, theories, and concepts in their chosen field of study.
2. Graduates should possess the necessary technical skills and competencies related to their discipline, including laboratory techniques and data analysis.
3. Graduates should be able to identify, analyze, and solve complex problems using logical and critical thinking skills. They should be able to apply scientific methods and principles to investigate and find solutions.
4. Graduates should be proficient in effectively communicating scientific information, both orally and in writing.
5. Graduates should have a basic foundation in research methods and be capable of designing and conducting scientific investigations.
6. Graduates should be able to work effectively as part of a team, demonstrating the ability to collaborate with others, respect diverse perspectives, and contribute to group projects.
7. Graduates should recognize the importance of ongoing learning and professional development. They should be equipped with the skills and motivation to continuously learn, adapt to new technologies and advancements in their field, and stay updated with current research.

Program Specific Outcome PSO (B.Sc. Chemistry):

After completion of this course, students are expected to learn/understand the following:

1	Fundamental concepts of thermochemistry, knowledge about gaseous state and electrolytic dissociation.
2	Students will also learn practical aspects of organic chemistry specially functional groups.
3	Various topics of inorganic chemistry which will be a base to improve their career in the area of inorganic chemistry. Student will learn various theories of inorganic chemistry and their application to define coordination complexes.

4	Prepare derivatives of simple organic compounds, water and soil quality parameters through physical and chemical analysis.

Multiple Entry and Multiple Exit options:

The multiple entry and exit options with the award of UG certificate/ UG diploma/ or three-year degree depending upon the number of credits secured;

Levels	Qualification Title	Credit Requirements		Semester	Year
		Minimum	Maximum		
4.5	UG Certificate	40	44	2	1
5.0	UG Diploma	80	88	4	2
5.5	Three Year Bachelor's Degree	120	132	6	3
6.0	Bachelor's Degree- Honours **Or** Bachelor's Degree- Honours with Research	160	176	8	4

Credit distribution structure for Three/ Four year Honors/ Honors with Research Degree Programme with Multiple Entry and Exit

F.Y. B.Sc.

Year (Level)	Sem	Major (Core). Subjects		Minor Subjects (MIN)	GE/ OE	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int, RP	Cumulative Credits/Sem	Degree/ Cumulative Cr.
		Mandatory (DSC)	Elective (DSE)							
1 (4.5)	I	DSC-1 (2T) DSC-2 (2T) DSC-3 (2P)	—	MIN-1 (2T) MIN-2 (2P)	OE-1 (2T)	SEC-1 (2T) SEC-2(1P)	AEC-1 (2T) (ENG) VEC-1 (2T) (ES) IKS (1T)	CC-1 (2)	22	UG Certificate
	II	DSC-4 (2T) DSC-5 (2T) DSC-6 (2P)	...	MIN-3 (2T) MIN-4 (2P)	OE-2 (2T)	SEC-3(2T) SEC-4(1P)	AEC-2 (2T) (ENG) VEC-2 (2T) (CI) IKS (1T)	CC-2 (2)	22	
	Cum. Cr.	12	...	8	4	6	10	4	44	
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor.										

S.Y. B.Sc.

Year (Level)	Sem	Subject-I (M-1) Major*		Subject-II (M-2) Minor #	Subject-III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
		Mandatory (DSC)	Elective (DSE)	(MIN)							
2 (5.0)	III	DSC-7(2T) DSC-8(2T) DSC-9(2P) DSC-10(2P)	---	MIN-5(2T) MIN-6(2T) MIN-7(2P)	---	OE-3(2T)		AEC-3(2T) (MIL)	CC-3(2T) CEP(2)	22	UG Diploma
	IV	DSC-11(2T) DSC-12(2T) DSC-13(2P) DSC-14(2P)	---	MIN-8(2T) MIN-9(2P)	---	OE-4(2T) OE-5(2P)		AEC-4(2T) (MIL)	CC-4(2T) ۞ FP(2)	22	
	Cum . Cr.	12	---	10	---	4	6	4	8	44	
	Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major & Minor.										

***** Student must choose one subject as a Major subject out of M-1, M-2 and M-3 that he/she has chosen at First year

#Student must choose one subject as a Minor subject out of M-1, M-2 and M-3 that he/she has chosen at First year (Minor must be other than Major)

۞ OJT/Internship/CEP should be completed in the summer vacation after 4th semester

T.Y. B.Sc.

Year (Level)	Sem	Subject-I (M-1) Major		Subject-II (M-2) Minor	Subject-III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
		Mandatory (DSC)	Elective (DSE)	(MIN)							
3 (5.5)	V	DSC-15(2T) DSC-16(2T) DSC-17(2T) DSC-18(2P) DSC-19(2P)	DSE-1A/B (2T) DSE-2A/B (2P)	---	---	---	VSC-1(2T) VSC-2(2P)	---	OJT/Int (4)	22	UG Degree
	VI	DSC-20(2T) DSC-21(2T) DSC-22(2T) DSC-23(2T) DSC-24(2T) IKS DSC-25(2P) DSC-26(2P)	DSE-3A/B (2T) DSE-4A/B (2P)	---	---	---	VSC-3(2T) VSC-4(2P)	---	---	22	
	Cum. Cr.	**24**	**8**	**---**	**---**	**---**	**8**	**---**	**4**	**44**	
	Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor										

Fourth Year B.Sc. (Honours)

Year (Level)	Sem	Major Core Subjects		Research Methodology (RM)	VSC, SEC (VSEC)	OE	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
IV (6.0)	VII	DSC-27(4T) DSC-28(4T) DSC-29(4T) DSC-30(2P)	DSE-5A/B (2T) DSE-6A/B (2P)	RM(4T)	---	---	---	---	22	UG Honours Degree
	VIII	DSC-31(4T) DSC-32(4T) DSC-33(4T) DSC-34(2P)	DSE-7A/B (2T) DSE-8A/B (2P)	---	---	---	---	OJT/Int (4)	22	
	Cum. Cr.	**28**	**8**	**4**	**---**	**---**	**---**	**4**	**44**	
Four Year UG Honors Degree in Major and Minor with 176 credits										

Fourth Year B.Sc. (Honours with Research)

Year (Level)	Sem	Major Core Subjects		Research Methodology (RM)	VSC, SEC (VSEC)	OE	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
IV (6.0)	VII	DSC-27(4T) DSC-28(4T) DSC-30(2P)	DSE-5A/B (2T) DSE-6A/B (2P)	RM(4T)	---	---	---	RP(4)	22	UG Honours with Research Degree
	VIII	DSC-31(4T) DSC-32(4T) DSC-34(2P)	DSE-7A/B (2T) DSE-8A/B (2P)	---	---	---	---	RP(8)	22	
	Cum. Cr.	**20**	**8**	**4**	**---**	**---**	**---**	**12**	**44**	
Four Year UG Honours with Research Degree in Major and Minor with 176 credits										

Sem- Semester, **DSC**- Department Specific Course, **DSE**- Department Specific Elective, **OE/GE**- Open/Generic elective, **VSC**- Vocational Skill Course, **SEC**- Skill Enhancement Course, **VSEC**- Vocation and Skill Enhancement Course, **AEC**- Ability Enhancement Course, **IKS**- Indian Knowledge System, **VEC**- Value Education Course, **T**- Theory, **P**- Practical,**CC**-Co-curricular **RM**- Research Methodology, **OJT**- On Job Training, **FP**- Field Project, **Int**- Internship, **RP**- Research Project, **CEP**- Community Extension Programme, **ENG**- English, **CI**- Constitution of India, **MIL**- Modern Indian Laguage

- Number in bracket indicate credit
- The courses which do not have practical 'P' will be treated as theory 'T'
- If student select subject other than faculty in the subjects M-1, M-2 and M-3, then that subject will be treated as Minor subject, and cannot be selected as Major at second year.

Details of S.Y. B.Sc. (Chemistry)

Course	Course Type	Course Code	Course Title	Credits	Teaching Hours/ Week			Marks			
					T	P	Total	Internal		External	
								T	P	T	P
Semester III, Level – 5.0											
DSC-7	DSC	CHE-DSC-231	Elementary Physical Chemistry	2	2	---	2	20	---	30	---
DSC-8	DSC	CHE-DSC-232	Stereochemistry and Heterocyclic Chemistry	2	2	---	2	20	---	30	---
DSC-9	DSC	CHE-DSC-233	Preparation and Analysis of Organic Compounds	2	---	4	4	---	20	---	30
DSC-10	DSC	CHE-DSC-234	Physicochemical Analysis of Soil and Water	2	---	4	4	---	20	---	30
MIN-5	MIN	CHE-MIN-231	Physical Chemistry for Chemists	2	2	---	2	20	---	30	---
MIN-6	MIN	CHE-MIN-232	Basics of Stereochemistry	2	2	---	2	20	---	30	---
MIN-7	MIN	CHE-MIN-233	Practicals in Chemical Analysis	2	---	4	4	---	20	---	30
OE-3	OE	CHE-OE-231	Chemistry of Matter	2	2	---	2	20	---	30	---
CEP	CEP	CHE-CEP-231	Community Engagement Program	2	---	4	4	50	---	---	---
Semester IV, Level – 5.0											
DSC-11	DSC	CHE-DSC-241	Essentials of Physical Chemistry	2	2	---	2	20	---	30	---
DSC-12	DSC	CHE-DSC-242	Concepts in Inorganic Chemistry	2	2	---	2	20	---	30	---
DSC-13	DSC	CHE-DSC-243	Practicals in Physical and Inorganic Chemistry	2	---	4	4	---	20	---	30
DSC-14	DSC	CHE-DSC-244	Volumetric Analysis	2	---	4	4	---	20	---	30
MIN-8	MIN	CHE-MIN-241	Basic Concepts in Inorganic Chemistry	2	2	---	2	20	---	30	---
MIN-9	MIN	CHE-MIN-242	Titrimetric Analysis	2	---	4	4	---	20	---	30
OE-4	OE	CHE-OE-241	Environment, Ecology and Climate Change	2	2	---	2	20	---	30	---
OE-5	OE	CHE-OE-242	Introduction to Chemistry Laboratory	2	---	4	4	---	20	---	30
FP	FP	CHE-FP-241	Field Projects	2	---	4	4	50	---	---	---

Examination Pattern

Theory Question Paper Pattern:

- 30 (External) +20 (Internal) for 2 credits
    - External examination will be of 1½ hours duration
    - There shall be 3 questions: Q1 carrying 6 marks and Q2, Q3 carrying 12 marks each. The tentative pattern of question papers shall be as follows;
    - Q1 Attempt any 2 out of 3 sub-questions; each 3 marks
    - Q 2 and Q3 Attempt any 3 out of 4 sub-question; each 4 marks.

Rules of Continuous Internal Evaluation:

The Continuous Internal Evaluation for theory papers shall consist of two methods:

1. Continuous & Comprehensive Evaluation (CCE): CCE will carry a maximum of 30% weightage (30/15 marks) of the total marks for a course. Before the start of the academic session in each semester, the subject teacher should choose any three assessment methods from the following list, with each method carrying 10/5 marks:

i. Individual Assignments
ii. Seminars/Classroom Presentations/Quizzes
iii. Group Discussions/Class Discussion/Group Assignments
iv. Case studies/Case lets
v. Participatory & Industry-Integrated Learning/Field visits
vi. Practical activities/Problem Solving Exercises
vii. Participation in Seminars/Academic Events/Symposia, etc.
viii. Mini Projects/Capstone Projects
ix. Book review/Article review/Article preparation
x. Any other academic activity
xi. Each chosen CCE method shall be based on a particular unit of the syllabus, ensuring that three units of the syllabus are mapped to the CCEs.

2. Internal Assessment Tests (IAT): IAT will carry a maximum of 10% weightage (10/5 marks) of the total marks for a course. IAT shall be conducted at the end of the semester and will assess the remaining unit of the syllabus that was not covered by the CCEs. The subject teacher is at liberty to decide which units are to be assessed using CCEs and which unit is to be assessed on the basis of IAT.The overall weightage of Continuous Internal Evaluation (CCE + IAT) shall be 40% of the total marks for the course. The remaining 60% of the marks shall be allocated to the semester-end examinations.The subject teachers are required to communicate the chosen CCE methods and the corresponding syllabus units to the students at the beginning of the semester to ensure clarity and proper preparation.

Practical Examination Credit 2: Pattern (30+20)

External Practical Examination (30 marks):

- Practical examination shall be conducted by the respective department at the end of the semester.
- Practical examination will be of 3 hours duration and shall be conducted as per schedule.
- Practical examination shall be conducted for 2 consecutive days for 2 hr/ day where incubation conditionis required.
- There shall be 05 marks for journal and viva-voce. Certified journal is compulsory to appear for practical examination.
- External practical examination of SEC will be of 25 marks and there will be no internal exam for SEC practical.

Internal Practical Examination (20 marks):

- Internal practical examination of 10 marks will be conducted by department as per schedule given.
- For internal practical examination student must produce the laboratory journal of practicals completed along with the completion certificate signed by the concerned teacher and the Head of the department.
- There shall be continuous assessment of 30 marks based on student performance throughout the semester. This assessment can include quizzes, group discussions, presentations and other activities assigned by the faculty during regular practicals. For details refer internal theory examination guidelines.
- Finally 40 (10+30) marks performance of student will be converted into 20 marks.

S.Y.B.Sc.
(Chemistry)
Semester III

S.Y. B.Sc. Chemistry (Major)
Semester-III
CHE-DSC-231: Elementary Physical Chemistry

Total Hours: 30 **Credits: 2**

Course objectives	• To orient and acquaint the UG students towards the fundamental concepts of physical chemistry • To acquire knowledge about gaseous state and electrolytic dissociation • To learn the concepts of solutions • To study and understand the concepts of thermochemistry	
Course outcomes	After successful completion of this course, students are expected • To understand the fundamental concept of the gaseous state • To understand the core study of electrolytic dissociation • To understand the concept of solution preparation • To the learn fundamental concepts of thermochemistry	
Unit	**Topic Particular**	**Hours**
Unit I	**Gaseous State** General characteristics of gases, Parameters (Volume, Pressure Temperature and Number of moles) of a gas, Gas laws (Boyle's law, Charles law, Avogadro's law), Ideal-gas equation, Kinetic molecular theory of gases, Deviations from ideal behaviour, Compressibility factor, Effect of pressure and temperature variation on deviations, van der Waals equation, Liquefaction of gases-Critical phenomenon, Critical constants, Related numericals.	**8**
Unit II	**Theory of Electrolytic Dissociation** Arrhenius theory of ionization, Migration of ions, Relative speed of ions: Hittorf's rule, Transport number and its determination by Hittorf's and Moving boundary method, Kohlrausch's law of independent migration of ions and its application for the calculation of degree of dissociation, Conductometric titration: Titration of a strong acid against a strong base, Titration of a weak acid against a strong base, Titration of a strong acid against a weak base, Titration of a weal acid against a weak base, Related numericals.	**8**
Unit III	**Solutions** Concentration of solutions, Ways of expressing concentration (Per cent by volume, Per cent by weight, Molarity, Molality, Mole fraction), Solutions of gases in gases, Henry's law, Solutions of liquids in liquids, Solubility of completely miscible liquids, Solubility of partially miscible liquids, Phenol-water system, Triethylamine-water system, Nicotine-water system, Vapour pressures of liquid-liquid solutions: First type of mixtures of miscible	**7**

	liquids, Second type of mixtures of miscible liquids, Third type of mixtures of miscible liquids, Solutions of solids in liquids, Related numericals.	
Unit IV	**Thermochemistry** Enthalpy of a reaction, Exothermic and endothermic reactions, Thermochemical equations, Heat of reaction and its types (Heat of formation, Heat of combustion, Heat of solution, Heat of neutralization), Measurement of heat of reaction, Related numericals.	**7**
References	• Maron, S. H., and Prutton, C. F. (2012). Principles of Physical Chemistry (4th Edition), Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. • Bahl, B. S., Bahl, A., and Tuli, G. D. (2005). Essentials of Physical Chemistry, S. Chand and Co Ltd., New Delhi. • Puri, B. R., Sharma, L. R., and Pathania, M. S. (2007). Principles of Physical Chemistry (42nd Edition), Vishal Publishing Co., Jalandhar. • Atkins, P. W. (1998). Physical Chemistry, ELBS. • Barrow, G. M. (2003). Physical Chemistry, International Student Edition. • Moore, W. J. (1998). Physical Chemistry, Orient Longman. • McQuarrie, D. A., and Simon, J. D. (2006). Physical Chemistry - A Molecular Approach, Viva Books Pvt. Ltd., New Delhi.	

S.Y. B.Sc. Chemistry (Major)
Semester-III
CHE-DSC-232: Stereochemistry and Heterocyclic Chemistry

Total Hours: 30 **Credits: 2**

Course objectives	• To study stereoisomerism in organic compound. • To study the different types stereoisomerism structure related with stability. • To study structure of 5-membered and 6-membered heterocyclic compounds. • To study synthesis and reactions of5-membered and 6-membered heterocyclic compounds.	
Course outcomes	After successful completion of this course, students are expected • To recognize stereochemistry of organic compounds. • To understand and predict the stability associated with stereochemistry. • To learn preliminary knowledge of 5-membered and 6-membered heterocyclic compounds. • To understand synthesis and reactions of5-membered and 6-membered heterocyclic compounds.	
Unit	**Contents**	**Hours**
Unit I	**Basic of Stereochemistry** Introduction, Stereoisomerism and its types, Flying wedge formula, Fischer Projection, Newman and Sawhorse projection formula and their interconversions. **Geometrical isomerism:** cis–trans and, syn-anti isomerism E/Z notations withCahn–Ingold–Prelog priority rules. **Optical Isomerism:** Optical activity, Specific rotation, Chirality/Asymmetry,Enantiomers, Diastereomers, Mesostructures, Racemic mixture and methods of resolution.R/S designations with Cahn–Ingold–Prelog priority rules.	**8**
Unit II	**Conformational Isomerism** Conformational isomerism: Introduction,conformational structure and stability of ethane, n-butane, cyclohexane, chair andboat forms, axial and equatorial bonds in cyclohexane, factors affecting stabilityof conformations. Baeyer's angle strain theory.	**7**
Unit III	**5-Membered Heterocyclic Compounds** Introduction, Structure, Nomenclature and aromaticity in 5- membered rings containing one heteroatom (Furan, Pyrrole, Thiophene and Pyridine).	**8**

	Synthesis: Paal-Knorr furan synthesis, Knorr pyrrole synthesis, Paal-Knorr Thiophene Synthesis. Reactions with Mechanism: nitration sulphonation, Friedel-Crafts Acylation ofFuran, Pyrrole, Thiophene.	
Unit IV	**6-Membered Heterocyclic Compounds** Introduction, Structure, Nomenclature and aromaticity In 6-membered rings containing one heteroatom (Pyridine), Hantzsch pyridine synthesis.Electrophilic substitution (Nitration Sulphonation) in pyridine.	**7**
Study Resources	• Morrison, R. T. and Boyd, R. N., (2007), Organic Chemistry, sixth edition, Dorling Kindersley (India) Pvt.Ltd. (Pearson Education). • Finar, I. L., (2020), Organic Chemistry (Volume 1), sixth edition, Dorling Kindersley (India) Pvt. Ltd.(Pearson Education) • Ahluwalia V. K. & Parashar R. K., (2010), Organic Reaction Mechanism (Fourth Edition), Narosa. • Kalsi P. S., (2019), Stereochemistry Conformation and Mechanism, Tenth Edition, New Age International Publishers • Ernest L. Eliel and Samuel H. Wilen, (2008) Stereochemistry of Organic Compound; Wiley.	

S.Y. B.Sc. Chemistry (Major)
Semester-III
CHE-DSC-233: Preparation and analysis of Organic compounds
Total Hours: 60 **Credits: 2**

Course objectives	• To identify the organic compounds through chemical and physical analysis. • To study the analysis of elements present in a given compound. • To study synthesis of organic compounds using different organic reactions. • To study the preparation of derivatives of different compounds.	
Course Outcomes	After successful completion of this course, students are expected to • To identify functional groups and structure of compounds. • To know the elements present in a given compound. • To utilise the theoretical knowledge for organic synthesis. • To prepare derivatives of simple organic compounds.	
Sr. No.	**Contents (Any 15)**	**Hours**
	Organic Qualitative Analysis (Any Eight)	
	Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols and carbonyl compounds) (Minimum **Eight** compounds).	**4 x 8**
	B) Organic Preparations and derivatives: (Any Seven)	
1	Preparation of methyl orange.	**4**
2	Preparation of 2,4 dinitrophenyl hydrazone derivatives of aldehydes or ketone	**4**
3	Preparation of Aspirin from salicylic acid.	**4**
4	Preparation of 2-naphthol aniline dye.	**4**
5	Preparation of p-bromo acetanilide from acetanilide.	**4**
6	Preparation of dibenzalpropanone from benzaldehyde.	**4**
7	Synthesis of semicarbazone derivative of aldehydes/ ketone.	**4**
8	Synthesis of benzoyl derivative of Aldehydes/ amine.	**4**
9	Draw chemical structure by using Chem draw software.	**4**
Study Resources	• Mendham, J., (2009). Vogel's Quantitative Chemical Analysis ,6th Ed., Pearson. • Mendham, J. (2009). Vogel's Quantitative Chemical Analysis, 6th Ed, Pearson Education Limited, New Delhi. • Vogel, A. I., Tatchell, A. R., Furnis, B. S., Hannaford, A. J. and Smith, P. W. G. (1996). Practical Organic Chemistry, 5th Ed, Prentice-Hall. • Mann, F. G., Saunders, B. C., (1960). Practical Organic Chemistry, 4th Ed, New Delhi Orient Longman. • Madan, R. L. (2023). Chemistry for B. Sc. Students, Analytical and Organic Chemistry-I, 1st Ed, S. Chand	

S.Y. B.Sc. Chemistry (Major)
Semester-III
CHE-DSC-234: Physicochemical Analysis of Soil and Water
Total Hours: 60 **Credits: 2**

Course objectives	• To study the methods of physical analysis of water. • To study the methods of chemical analysis of water. • To study the quality of soil. • To study the integrity of soil.	
Course Outcomes	After successful completion of this course, students are expected • To check the water and soil quality parameters through physical and chemical analysis. • To analyse water and soil samples. • To understand soil quality. • To apply the analysis technique for betterment of soil quality.	
Sr. No.	**Contents (Any 15)**	**Hours**
	Analysis of Chemical Parameters of Water (Any Eight)	
1	To determine the pH of water sample.	**4**
2	To determine the electrical conductivity of water sample.	**4**
3	To determine the presence of metals in the industrial wastewater samplesby spot test.	**4**
4	To determine the nitrate or nitrite in the given water sample.	**4**
5	To determine the calcium hardness of the given water sample.	**4**
6	To determine the magnesium hardness of the given water sample.	**4**
7	Determination of TDS in the industrial wastewater sample.	**4**
8	Determination of chloride content in the water sample.	**4**
9	Determination of free carbon dioxide in a water sample.	**4**
10	To determine the chlorides in the given water sample by chlorotex method.	**4**
	Analysis of Chemical Parameters of Soil (Any Seven)	
11	To determine the pH of soil sample.	**4**
12	To determine the electrical conductivity of soil sample.	**4**
13	To determine the alkalinity of soil sample.	**4**
14	To determine the maximum water holding capacity of soil sample.	**4**
15	To determine the dissolved organic matter from soil sample by Walkey and Black method.	**4**
16	To determine the magnesium in soil sample.	**4**
17	To determine the calcium carbonate of soil sample.	**4**
18	To determine the bulk density of the given soil sample.	**4**
19	To determine the calcium from soil sample.	**4**
20	To determine the chlorides in the soil sample by chlorotex method.	**4**

Study Resources	• Maiti, S. K., (2011). Handbook of Methods in Environmental Studies, ABDPublishers, Oxford Book Company, • Shafi, S.M., (2005). Environmental Pollution, Atlantic Publisher, New Delhi. • Ahulwalia, V. K., (2015). Environmental Pollution and Health, TERI Press, New Delhi. • Gupta, I. C., Yaduvanshi, N.P.S. and Gupta, S.K.(2020). Standard methods for analysis of soil plant and water, Scientific Publisher.	

S.Y. B.Sc. Chemistry (Minor)
Semester-III
CHE-MIN-231: Physical Chemistry for Chemists

Total Hours: 30 **Credits: 2**

Course objectives	• To orient and acquaint the UG students towards the fundamental concepts of physical chemistry • To acquire knowledge about gaseous state and electrolytic dissociation • To learn the concepts of solutions • To study and understand the concepts of thermochemistry	
Course outcomes	After successful completion of this course, students are expected • To understand the fundamental concept of the gaseous state • To learn the core study of electrolytic dissociation • To understand the concept of solution preparation • To understand the fundamental concepts of thermochemistry	
Unit	**Topic Particular**	**Hours**
Unit I	**Gaseous State** General characteristics of gases, Parameters (Volume, Pressure Temperature and Number of moles) of a gas, Gas laws (Boyle's law, Charles law, Avogadro's law), Ideal-gas equation, Kinetic molecular theory of gases, Related numericals.	**8**
Unit II	**Theory of Electrolytic Dissociation** Arrhenius theory of ionization, Migration of ions, Relative speed of ions: Hittorf's rule, Kohlrausch's law of independent migration of ions and its application for the calculation of degree of dissociation, Conductometric titration: Titration of a strong acid against a strong base, Titration of a weak acid against a strong base, Related numericals.	**8**
Unit III	**Solutions** Concentration of solutions, Ways of expressing concentration (Per cent by volume, Per cent by weight, Molarity, Molality, Mole fraction), Solutions of gases in gases, Henry's law, Solutions of liquids in liquids, Solubility of completely miscible liquids, Related numericals.	**7**
Unit IV	**Thermochemistry** Enthalpy of a reaction, Exothermic and endothermic reactions, Thermochemical equations, Heat of reaction and its types (Heat of formation, Heat of combustion, Heat of solution, Heat of neutralization), Measurement of heat of reaction, Related numericals.	**7**
References	• Maron, S. H., and Prutton, C. F. (2012). Principles of Physical Chemistry (4th Edition), Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. • Bahl, B. S., Bahl, A., and Tuli, G. D. (2005). Essentials of Physical Chemistry, S. Chand and Co Ltd., New Delhi. • Puri, B. R., Sharma, L. R., and Pathania, M. S. (2007). Principles of Physical Chemistry (42nd Edition), Vishal Publishing Co.,	

	Jalandhar. • Atkins, P. W. (1998). Physical Chemistry, ELBS. • Barrow, G. M. (2003). Physical Chemistry, International Student Edition. • Moore, W. J. (1998). Physical Chemistry, Orient Longman. • McQuarrie, D. A., and Simon, J. D. (2006). Physical Chemistry - A Molecular Approach, Viva Books Pvt. Ltd., New Delhi.	

S.Y. B.Sc. Chemistry (Minor)
Semester-III
CHE-MIN-232: Basics ofStereochemistry

Total Hours: 30 **Credits: 2**

Course objectives	• To study basics of stereoisomerism in organic compound. • To study the different types of stereoisomerism structure related with stability. • To study conformational isomers of ethane and n-butane. • To study conformational isomers of cyclohexane.	
Course outcomes	After successful completion of this course, students are expected • To recognize the basics stereochemistry of organic compounds. • To understand and predict the stability associated with stereochemistry. • To learn conformational isomers of ethane and n-butane. • To understand conformational isomers of cyclohexane.	
Unit	**Contents**	**Hours**
Unit I	**Basic of Stereochemistry** Introduction, Stereoisomerism and its types, Flying wedge formula, Fischer Projection, Newman and Sawhorse Projection formula and their interconversions. **Geometrical isomerism:** cis–trans and, syn-anti isomerism E/Z notations withCahn–Ingold–Prelog priority rules.	**8**
Unit II	**Optical Isomerism** Optical Activity, Specific Rotation, Chirality/Asymmetry,enantiomers, Diastereomers, Mesostructures, Racemic mixture and Methods of resolution.R/S designations with Cahn–Ingold–Prelog priority rules.	**7**
Unit III	**Conformational isomerism** Conformational isomerism: Introduction, Conformational structure and stability of ethane, n-butane.	**7**
Unit IV	**Conformationalcyclohexane** Cyclohexane, Chair and Boat forms, Axial and equatorial bonds in cyclohexane, Factors affecting stabilityof conformations. Baeyer's angle strain theory.	**8**
Study Resources	• Morrison, R. T. and Boyd, R. N., (2007), Organic Chemistry, sixth edition, DorlingKindersley (India) Pvt.Ltd. (Pearson Education). • Finar, I. L., (2020), Organic Chemistry (Volume 1), sixth edition, Dorling Kindersley(India) Pvt. Ltd.(Pearson Education) • Ahluwalia V. K. & Parashar R. K., (2010), Organic Reaction Mechanism (FourthEdition), Narosa. • Kalsi P. S., (2019), Stereochemistry Conformation and Mechanism, Tenth Edition,New Age International Publishers • Ernest L. Eliel and Samuel H. Wilen, (2008) Stereochemistry of Organic Compound; Wiley.	

S.Y. B.Sc. Chemistry (Minor)
Semester-III
CHE-MIN-233: Practicals in Chemical Analysis

Total Hours: 60 **Credits: 2**

Course objectives	• To study the methods of physical analysis of water. • To study the methods of chemical analysis of water. • To study the quality of soil. • To study the integrity of soil.	
Course Outcomes	After successful completion of this course, students are expected • To check the water and soil quality parameters through physical and chemical analysis. • To analyse water and soil samples. • To understand soil quality. • To apply the analysis technique for betterment of soil quality.	
Sr. No.	**Contents (Any 15)**	**Hours**
	Analysis of Chemical Parameters of Water (Any Eight)	
1	To determine the pH of water sample.	**4**
2	To determine the electrical conductivity of water sample.	**4**
3	To determine the presence of metals in the industrial waste water samples by spot test.	**4**
4	To determine the nitrate or nitrite in the given water sample.	**4**
5	To determine the calcium hardness of the given water sample.	**4**
6	To determine the magnesium hardness of the given water sample.	**4**
7	Determination of TDS in the industrial waste water sample.	**4**
8	Determination of chloride content in the water sample.	**4**
9	Determination of free carbon dioxide in a water sample.	**4**
10	To determine the residual chlorine in the given water sample by chlorotex method.	**4**
	Analysis of Chemical Parameters of Soil (Any Seven)	
11	To determine the pH of soil sample.	**4**
12	To determine the electrical conductivity of soil sample.	**4**
13	To determine the alkalinity of soil sample.	**4**
14	To determine the maximum water holding capacity of soil sample.	**4**
15	To determine the dissolved organic matter from soil sample by Walkey and Black method.	**4**
16	To determine the magnesium in soil sample.	**4**
17	To determine the calcium carbonate of soil sample.	**4**
18	To determine the bulk density of the given soil sample.	**4**
19	To determine the calcium from soil sample.	**4**
20	To determine the residual chlorine in the soil sample by Chlorotex method.	**4**

Study Resources	• Maiti, S. K., (2011). Handbook of Methods in Environmental Studies, ABDPublishers, Oxford Book Company, • Shafi, S.M., (2005). Environmental Pollution, Atlantic Publisher, New Delhi. • Ahulwalia, V. K., (2015). Environmental Pollution and Health, TERI Press, New Delhi. • Gupta, I. C., Yaduvanshi, N.P.S. and Gupta, S.K.(2020). Standard methods for analysis of soil plant and water, Scientific Publisher.	

S.Y. B.Sc. Chemistry (Open Elective)
Semester-III
CHE-OE-231: Chemistry of Matter

Total Hours: 30 **Credits: 2**

Course objectives	• To observe the physical change in our surrounding. • To scientifically understand the daily life experiences such as pressure, evaporation etc. • To learn and appreciate the efforts of scientists made over the time like various models of atoms, laws and theories. • To write chemical formulae of simple compound, chemical equations etc.	
Course outcomes	After successful completion of this course, students are expected • To classify matter based on their states (solid/liquid/gas) and composition (element/ compound/ mixture) etc. • To verify the facts, principles, phenomena or to seek answers to queries on their own such as effect of change of pressure, evaporation etc. • To understand various laws and composition of matter.	
Unit	**Contents**	**Hours**
Unit I	**Matter in Our Surroundings** Physical Nature of Matter, Characteristics of Particles of Matter, States of Matter, States of Matter, Effect of change of pressure, Evaporation, Factors affecting evaporation, Effect of evaporation.	**8**
Unit II	**Classification of Matter** Classification of matter, Mixture and its types, Solution, Properties of a solution, Concentration of a solution, (i) mass by mass percentage of a solution (ii) mass by volume percentage of a solution (iii) volume by volume percentage of a solution, Suspension, Properties of suspension, colloidal solution, Physical and chemical changes of matter, types of pure substances, Elements, Compounds.	**7**
Unit III	**Atoms and Molecules** Laws of chemical combination, Law of conservation of mass, Law of constant proportions, Dalton's atomic theory, Atom, Modern day symbols of atoms of different elements, Atomic mass, Molecule, Molecules of elements, Molecules of compounds, Ion, Writing chemical formulae, molecular mass, Formula unit mass.	**8**
Unit IV	**Structure of the Atom** Charged particles in matter, Structure of an atom, Thomson's model of an atom, Rutherford's model of an atom, Bohr's model of atom, Neutrons, Orbits, Valency, Atomic number and mass number, Isotopes and its applications,I.	**7**

Study Resources	• Manas Chanda (2019) Atomic Structure and Chemical Bond: A Problem solving approach, Dreamtech press. • Debbie and Richard Lawrence (2019) Properties of Atoms and Molecules, God's Design, 4th edition. • Madan, Malik, Tuli (1998) Selected topics in Inorganic Chemistry, S. Chand.	

S.Y. B.Sc. Chemistry (Major)
Semester-III
CHE-CEP-231: Community Engagement Program (CEP)

Total Hours: 60 **Credits: 2**

In alignment with the National Education Policy (NEP) 2020, Moolji Jaitha College (Autonomous), Jalgaon is introducing the Community Engagement Program at the undergraduate level. The NEP 2020 emphasizes holistic development, inclusivity, and integrating vocational education with academic learning, aiming to nurture socially responsible individuals. Inspired by NEP 2020, the Community Engagement Program aim to produce knowledgeable, compassionate, and proactive graduates, contributing to a more just, equitable, and sustainable society. This course fosters a strong connection between education and socioeconomic problems of real-world. Students will learn about the challenges faced by vulnerable households and appreciate local wisdom and lifestyles.

Objectives

- To engage students in activities that promote emotional, social, and intellectual growth, fostering a well-rounded approach to personal and academic development.
- To provide hands-on experiences that complement classroom learning, enabling students to apply their knowledge insocioeconomic problems of real-world.
- To instil a sense of responsibility towards the community by encouraging students to actively participate in social and environmental initiatives, appreciate rural culture, lifestyle, and wisdom.

Course Outcomes

After completing this course, students will be able to

- Understand rural and/or urban culture, ethos, and socioeconomic realities.
- Develop a sense of empathy with the local community while appreciating the significant contributions of local communities to society and the economy.
- Learn to value the local community wisdom and identify opportunities for contributing to the community's socioeconomic improvements.

Activities

- Conduct workshops and interactive sessions on emotional intelligence and social skills.
- Organize debates, discussions, and intellectual challenges that stimulate critical thinking and socioeconomic problem-solving using concern subject.
- Organize field visits where students can work on real-world problems, such as environmental conservation, rural and/or urban planning, or community health.
- Organize internships or service-learning opportunities with local businesses, NGOs, or government agencies.
- Facilitate project-based learning activities that require students to use their academic knowledge to develop solutions to community issues.
- Engage students in community service activities that address local social and environmental issues.
- Organize cultural exchange programs or field trips to rural areas to foster an appreciation of rural culture and wisdom.

- Facilitate collaborative projects involving students, educators, and community members to develop solutions for local challenges, promoting teamwork and collective problem-solving.
- Conduct educational sessions on the status of various agricultural and development programs and the challenges faced by vulnerable households, ensuring inclusivity and accessibility for all students.

S. No.	Module Title	Module Content	Assignment submission	Teaching/ Learning Methodology
1	**Appreciation of Rural Society**	Rural lifestyle, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages', rural infrastructure.	Prepare a map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village.	– Classroom discussions – Field visit – Assignment
2	**Understanding rural and local economy and livelihood**	Agriculture, farming, land ownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets, migrant labour.	Describe your analysis of the rural house hold economy, its challenges and possible pathways to address. Circular economy and migration patterns.	– Field visit – Group discussions in class – Assignment
3	**Rural and local Institutions**	Traditional rural and community organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), Nagarpalikas and municipalities, local civil society, local administration.	How effectively are Panchayati Raj and Urban Local Bodies (ULBs) institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual).	– Classroom – Field visit – Group presentation of assignment
4	**Rural and National Development Programmes**	History of rural development and current national programmes in India: SarvaShikshaAbhiyan, BetiBachao, BetiPadhao, Ayushman Bharat, Swachh Bharat, PM AwaasYojana, Skill India, Gram Panchayat Decentralised Planning, National Rural	Describe the benefits received and challenges faced in the delivery of one of these programmes in the local community; give suggestions about improving the implementation of the programme for the poor. Special	– Classroom – Each student selects one program for field visit – Written assignment

		Livelihood Mission (NRLM), Mahatma Gandhi National Rural Employment Guarantee Act 2005 (MGNREGA), SHRAM, Jal Jeevan Mission, Scheme of Fund for Regeneration of Traditional Industries (SFURTI), AtmaNirbhar Bharat, etc.	focus on the urban informal sector and migrant households.	

Note: The modules are suggestive in nature and students can opt any one activities for community engagement program and field project based on topic appropriate to their regional community context.

Some additional suggestive themes for field-based / community engagement activities are listed below:

- Management curriculum may include aspects of micro-financing in a rural context;
- Chemistry syllabus can have a component of conducting water and soil analysis in surrounding field areas;
- Political science syllabus could include a mapping of local rural governance institutions and their functioning.
- Environment education will include areas such as climate change, pollution, waste management, sanitation, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living
- Understanding panchayats and constitutional mandate of local governance
- Panchayat administration, Gram Sabha, Mahila Sabha, Gram Panchayat Development Plan (GPDP), local planning of basic services.
- Micro-finance, SHGs, system of savings and credit for local business, linkages to banks, financial inclusion.
- Rural – entrepreneurship, opportunities for small business in local communities, access to financial and technical inputs to new entrepreneurs.
- Renewable energy, access to household and community level solar and bio-mass systems for sustainable energy use.
- Participatory Monitoring and evaluation of socio-economic development programmes, and cost-benefit analysis of project proposals.
- Migrant workers' livelihood security and social services.
- Hygiene and sanitation, improving health and personal behaviours, locally manageable decentralised systems and awareness against stubble burning.
- Water conservation, traditional practices of storage and harvesting, new systems of distribution and maintenance.
- Women's empowerment, gender inequality at home, community and public spaces, safety of girls and women, access to skills, credit and work opportunities.
- Child security, safety and good parenting, nutrition and health, learning and training for child care.

- Rural Marketing, market research, designing opportunities for rural artisans and crafts, and new products based on demand assessment.
- Community Based Research in Rural Settings, undertaking research that values local knowledge, systematises local practices and tools for replication and scale-up.
- Peri-urban development of informal settlements, mapping and enumeration, design of local solutions.

Assessment:

- Readings from related literature including e-content and reflections from field visits should be maintained by each student in the form of Field Diary (20 Marks)
- Submission of assignments based on modules assignment submission (details mentioned above) (20 Marks)
- Oral/ Group discussion/ Presentation (10 Marks)

S.Y.B.Sc.
(Chemistry)
Semester IV

S.Y. B.Sc. Chemistry (Major)
Semester-IV
CHE-DSC-241: Essentials of Physical Chemistry
Total Hours: 30 **Credits: 2**

Course objectives	• To orient and acquaint the UG students towards the fundamental concepts of physical chemistry • To acquire knowledge about colligative properties and their applications • To learn the concepts of electrochemistry • To study and understand the concepts of chemical thermodynamics and chemical equilibrium	
Course outcomes	After successful completion of this course, students are expected • To understand importance of colligative properties • To learn the core study of electrochemistry • To understand impotence of chemical thermodynamics • To learn the fundamental concepts of chemical equilibrium	
Unit	**Topic Particular**	**Hours**
Unit I	**Theory of Dilute Solutions** Vapour pressure of a liquid, Raoult's law of vapour pressure, Colligative properties, Lowering of vapour pressure, Relative lowering of vapour pressure, Relation between relative lowering of vapour pressure and molar mass of solute, Elevation of boiling point, Relation between elevation of boiling point and molar mass of solute, Depression of freezing point, Relation between depression of freezing point and molar mass of solute, Osmotic pressure, van't Hoff equation for osmotic pressure of a solution, Determination of molar mass of a solute from osmotic pressure measurements, Related numericals.	**8**
Unit II	**Electromotive Force** Measurement of electromotive force of an unknown cell, Weston standard cell, Reversible cells, Relation between electromotive force and free energy, Determination of electromotive of a half-cell, Nernst equation, Reference electrode, Primary reference electrode: Standard Hydrogen Electrode (SHE), Secondary reference electrode: Standard silver-silver electrode, Calomel electrode, Glass electrode, Quinhydrone electrode, Determination of pH of a solution using the quinhydrone electrode and glass electrode, Potentiometric titrations (Acid-base titrations, Oxidation-reduction titrations and precipitation titrations), Related numericals.	**8**
Unit III	**Chemical Thermodynamics** Internal energy, First law of thermodynamics, Enthalpy of a system, Molar heat capacities, Molar heat capacity at constant volume (Cv) and Molar heat capacity at constant pressure (Cp), Relation between Cv and Cp, Joule-Thomson effect, Spontaneous processes, Entropy, Spontaneity and randomness, Second law of thermodynamics, Third law of thermodynamics, Standard entropy, Concept of residual entropy, Related numericals.	**7**

Unit IV	**Chemical Equilibrium** Reversible reactions, Nature of chemical equilibrium, Characteristics of chemical equilibrium, Law of mass action, Equilibrium constant, Equilibrium constant expression in terms of partial pressure, Relation between Kc and Kp, Units of equilibrium constant, Related numericals.	**7**
References	• Maron, S. H., and Prutton, C. F. (2012). Principles of Physical Chemistry (4th Edition), Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. • Bahl, B. S., Bahl, A., and Tuli, G. D. (2005). Essentials of Physical Chemistry, S. Chand and Co Ltd., New Delhi. • Puri, B. R., Sharma, L. R., and Pathania, M. S. (2007). Principles of Physical Chemistry (42nd Edition), Vishal Publishing Co., Jalandhar. • Atkins, P. W. (1998). Physical Chemistry, ELBS. • Barrow, G. M. (2003). Physical Chemistry, International Student Edition. • Moore, W. J. (1998). Physical Chemistry, Orient Longman. • McQuarrie, D. A., and Simon, J. D. (2006). Physical Chemistry - A Molecular Approach, Viva Books Pvt. Ltd., New Delhi. • Glasstone, S. (1965). An Introduction to Electrochemistry, Van Nostrand, East-West. • Robinson, R. A. and Stokes, R. H. (1959). Electrolytic Solutions, Butterworths, London.	

S.Y. B.Sc. Chemistry (Major)
Semester-IV
CHE-DSC-242: Concepts in Inorganic Chemistry
Total Hours: 30 **Credits: 2**

Course objectives	• To study d-block elements and their characteristics. • To study the concept of acids and bases. • To study chemistry of non-aqueous solvents. • To study the basic concept of coordination chemistry.	
Course outcomes	After successful completion of this course, students are expected to • Learn d-block elements and their characteristics. • Able to understand the concept of acids and bases. • Able to recognize chemistry of non-aqueous solvents. • Able to understand the basic concept of coordination chemistry	
Unit	**Contents**	**Hours**
Unit I	**d-block Elements and Their Characteristics** Elements of first, second and third transition series, General characteristics ofd-block elements1) Metallic character 2) Molar volume and densities 3) Atomic radii 4) IonicRadii 5) Melting and boiling points 6) Ionization Energies7) Reactivity 8)Oxidation states 9) Standard electrode potential 10) Reducing Properties 11) Colour 12) Magnetic properties 13) Catalytic Properties 14) Tendency to form complexes.	**8**
Unit II	**Acids and Bases** Arrhenium concept, Hydronium ion, Lowry and Bronsted theory, Lux and Flood concept, Autoionisation, Limitation of autoionization, Lewis concept, Effect of solvent on relative strength of acid and bases, Effect of polarity, Charge on species, Electronegativity on relative strength of acid and bases, Hard and soft acids.	**7**
Unit III	**Chemistry of non-aqueous solvents** Solvent, Classification of solvent: Protonic and aprotic solvents, Acidic, basic and amphiprotic solvents, Ionising and non-ionising solvents. Properties of solvents: Melting and boiling point of solvents, Heat of fusion and vaporization, Dielectric constant. Chemistry of Liquid ammonia, anhydrous sulphuric acid, Dinitrogen tetroxide, Molten salts.	**7**
Unit IV	**Basic Concept of Coordination Chemistry** Double salt, Coordination compound-introduction, Definition and terminology: coordination complex, Complex ion, Central ion, Ligands, coordination sphere, Charge on complex ion. Type of ligands: unidentate/monodentate, Bidentate, Polydentate ligands. Chelating ligand and chelates, Physical methods used in the study of complexes. Werner coordination theory. Nomenclature of coordination compounds as per IUPAC, stability of complexes.	**8**

Study Resources	• Puri, B. R., Sharma L. R., Kalia K. C., (2005). Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co. • Huheey, J. E., Keiter, E. A., and Keiter, R. L. (1993), Inorganic chemistry: principles of structure and reactivity, 4th edn, New York, NY: Harper Collins College Publishers. • Lee, J. D. (2006). Concise Inorganic Chemistry, 5^{th} edition, Blackwell Science, London. • Sharpe, A. G., (1981). Inorganic chemistry, 3rd edition, Pearson Education. • Cotton, F. A. (1991). Chemical applications of group theory. John Wiley & Sons. • Shrivers, D. F., Atkins, P. W. and Langfor C. H., (1990), Inorganic Chemistry, CH Langford.	

S.Y. B.Sc. Chemistry (Major)
Semester-IV
CHE-DSC-243: Practicals in Physical and Inorganic Chemistry

Total Hours: 60 **Credits: 2**

Course objectives	• To understand the qualitative analysis of Inorganic compounds. • To learn the calibration and components of instrument. • To study the analysis using potentiometer, conductometer etc. • To learn the preparation of coordination compounds. • To study the quantitative analysis.	
Course Outcomes	After successful completion of this course, students are expected • To analyse cation and anion present in inorganic compounds. • To set the instrument and run the experiment without error • To handle potentiometer, conductometer for physical analysis. • To understand the formation of co-ordination compound and role of ligands. • To analyse amount of substances through gravimetric analysis.	
Sr. No.	**Contents (Any 15)**	**Hours**
A	**Inorganic Qualitative analysis (Any Five compounds)**	**4**
	Analysis of inorganic compounds contaning cation and anion from given sample(Excluding phosphate and borate).	**4**
B	**Inorganic Preparations (Any Three)**	**4**
1	Preparation of Tetramine Copper (II) sulphate	**4**
2	Preparation of Ammonium Ferric Sulphate $[(NH_4)_2SO_4.Fe_2(SO_4)_3.24H_2O]$	**4**
3	Preparation of Copper (I) chloride	**4**
4	Preparation of Hexamine Ni (II) chloride	**4**
5	Preparation of Nitro penta-ammino cobalt (III) chloride	**4**
C	**Gravimetric Analysis (Any Two)**	**4**
1	Estimation of Ba as $BaSO_4$ (by ignition using filter paper)	**4**
2	Estimation of Ni as NI-DMG	**4**
3	Estimation of Pb as $PbCrO_4$	**4**
D	**Physical Chemistry Experiment (Any Six)**	**4**
1	Conductometric titration of hydrochloric acid with sodium hydroxide.	**4**
2	Conductometric titration of acetic acid with sodium hydroxide.	**4**
3	Preparation of 0.05 M potassium hydrogen phthalate solution and standardization of a given NaOH solution.	**4**
4	Determination of critical solution temperature of phenol-water system.	**4**
5	To determine the molecular weight of a given non-volatile solute by Landsberger's method.	**4**
6	To determine the molecular weight of a given non-volatile solute by depression in freezing point method.	**4**
7	To determine the Ecal (oxi.) using quinhydrone electrode.	**4**

8	To determine the pH of the given solutions using quinhydrone electrode.	**4**
9	Draw the graph for the given data using Microsoft excel and find out the value of slope of the graph. (Take printout of graph and attach it to student's Journal)	**4**
Study Resources	• Vogel, A. I. (1989). Textbook of Quantitative Inorganic Analysis, 5th Ed, Long Man. • Yadav, J. B., (2008). Advanced Practical Physical Chemistry, 5th Ed, Goel Publishing • Das, R. C., (1984). Experimental Physical Chemistry, McGraw Hill Education • Daniels, F. and Williams, J.(1941). Experimental Physical Chemistry, 3th Ed, McGraw Hill Education • Svehla, G. (2012). Vogel's Qualitative Inorganic Analysis, Pearson Education Limited, New Delhi. • Mendham, J. (2009). Vogel's Quantitative Chemical Analysis, 6th Ed, Pearson Education Limited, New Delhi.	

S.Y. B.Sc. Chemistry (Major)
Semester-IV
CHE-DSC-244: Volumetric Analysis

Total Hours: 60 **Credits: 2**

Course objectives	• To study primary standard and secondary standard solutions. • To learn solution preparation of various concentration. • To understand the standardization of solutions. • To learn volumetric analysis of various samples.	
Course Outcomes	After successful completion of this course, students are expected • To know primary standard and secondary standard solutions. • To utilise the knowledge of calculations for solutions preparation of different concentrations. • To measure the correct concentration of solution through standardisation. • To estimate the compound from given samples by quantitative analysis.	
Sr. No.	**Contents (Any 15)**	**Hours**
1.	Estimation of acetic acid in commercial vinegar using NaOH.	**4**
2.	Estimation of aspirin in the drug sample.	**4**
3.	Estimation of Mg^{+2} by complexometric titration with EDTA.	**4**
4.	Estimation of copper iodometrically.	**4**
5.	Estimation of Vitamin C in the given sample	**4**
6.	To estimate manganese volumetrically by Volhard's method.	**4**
7.	Determination of strength of H_2O_2 solution with $KMnO_4$	**4**
8.	Determination of molecular weight of given acid by volumetric method.	**4**
9.	Estimation of sodium carbonate content of washing soda.	**4**
10.	Estimation of chlorides by Mohr's method.	**4**
11.	Determination of the amount of cobalt from the given solution by complexometric method.	**4**
12.	Estimation of copper (II) sulphateby $Na_2S_2O_3$ using a standard $CuSO_4$ solution.	**4**
13.	Estimation of Aniline/phenol by bromination.	**4**
14.	Estimation of acetone by Iodination.	**4**
15.	Estimation of alkali content in anatacid tablet using HCl.	**4**
16.	Estimation of Aluminium (III) from the given aluminium salt solution by using Erichrome Black-T indicator	**4**
17.	Estimation of ethyl benzoate by hydrolysis	**4**
18.	Estimation of HCl by NaOH using a standard oxalic acid solution.	**4**
19.	Estimation of $KMnO_4$ by $Na_2S_2O_3$ using a standard $K_2Cr_2O_7$ solution.	**4**
20.	Estimation of Fe(II) by redox titration with $KMnO_4$	**4**
Study Resources	• Khopkar, S. M., (2008). Basic concepts of analytical chemistry. • Kamboj, P. C.,(2013). Systematic Practical Chemistry, 2nd Ed.Vishal Publication	•

	• Mukhopadhyay, R., Chatterjee, P. (2016). Advanced Practical Chemistry, 2nd Ed Books and Allied Ltd. • An Advanced Chemistry In Practical Chemistry,New CentralBook Agency(P) Ltd. • Svehla G., (2002) Vogel's Qualitative Inorganic Analysis, Pearson Education. • Mendham, J.,Denny R. C., Barnes, Thomas,(2009)., Quantitative chemical analysis. • Bassett, Denney, Jeffrery, (1989). Vogel's text book of quantitative inorganic analysis. • Nemade, A. M. ,Zope, V. S.,Rajput A.P.,Gujrathi R.B,A Textbook of Practical Chemistry, Prashant Publications.	

S.Y. B.Sc. Chemistry (Minor)
Semester-IV
CHE-MIN-241: Basic Concepts in Inorganic Chemistry

Total Hours: 30 **Credits:2**

Course objectives	• To study d-block elements. • To study the general characteristics of d block elements. • To study basic concepts of acids and bases. • To study the basic concept of coordination chemistry.	
Course outcomes	After successful completion of this course, students are expected • To learn d-block elements and their characteristics. • To understandgeneral characteristics of d block elements. • To understand the concept of acids and bases. • To understand the basic concept of coordination chemistry	
Unit	**Contents**	**Hours**
Unit I	**d-block Elements** Position in thePeriodic Table,Elements of first, second and third transition series, Electronic configuration of first, second and third transition series, Trends in atomic radii offirst, second and third transition series.	**8**
Unit II	**General characteristics of d blockelements** 1) Metallic character 2) Molar volume and densities 3) Melting and boiling points 4) Ionization Energies 5) Reactivity 6) Oxidation states	**7**
Unit III	**Acids and Bases** Arrhenium concept, Hydronium ion, Lowry and Bronsted theory, Lux and Flood concept, Autoionization, Limitation of autoionization, Lewis concept.	**7**
Unit IV	**Basic Concept of Coordination Chemistry** Double salt, Coordination compound-introduction, Definition, and terminology: Coordination complex, Complex ion, Central ion, Ligands, coordination sphere, Charge on complex ion. Type of ligands: unidentate/monodentate, Bidentate, Polydentate ligands. Chelating ligand and chelates.	**8**
Study Resources	• Puri, B. R., Sharma L. R., Kalia K. C., (2005). Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co. • Huheey, J. E., Keiter, E. A., and Keiter, R. L. (1993), Inorganic chemistry: principles of structure and reactivity, 4th edn, New York, NY: Harper Collins College Publishers. • Lee, J. D. (2006). Concise Inorganic Chemistry, 5th edition, Blackwell Science, London. • Sharpe, A. G., (1981). Inorganic chemistry, 3rd edition, Pearson Education. • Cotton, F. A. (1991). Chemical applications of group theory. John Wiley & Sons. • Shrivers, D. F., Atkins, P. W. and Langfor C. H., (1990), Inorganic Chemistry, CH Langford	

S.Y. B.Sc. Chemistry (Minor)
Semester-IV
CHE-MIN-242: Titrimetric Analysis

Total Hours: 60 **Credits: 2**

Course objectives	• To study primary standard and secondary standard solutions. • To learn solution preparation of various concentration. • To understand the standardization of solutions. • To learn volumetric analysis of various samples.	
Course Outcomes	After successful completion of this course, students are expected • To Know primary standard and secondary standard solutions. • To utilise the knowledge of calculations for solutions preparation of different concentrations. • To measure the correct concentration of solution through standardization. • To estimate the compound from given samples by quantitative analysis.	
Sr. No.	**Contents (Any 15)**	**Hours**
1.	Estimation of acetic acid in commercial vinegar using NaOH.	**4**
2.	Estimation of aspirin in the drug sample.	**4**
3.	Estimation of Mg^{+2} by complexometric titration with EDTA.	**4**
4.	Estimation of copper iodometrically.	**4**
5.	Estimation of Vitamin C in the given sample	**4**
6.	To estimate manganese volumetrically by Volhard's method.	**4**
7.	Determination of strength of H_2O_2 solution with $KMnO_4$	**4**
8.	Determination of molecular weight of given acid by volumetric method.	**4**
9.	Estimation of sodium carbonate content of washing soda.	**4**
10.	Estimation of chlorides by Mohr's method.	**4**
11.	Determination of the amount of cobalt from the given solution by complexometric method.	**4**
12.	Estimation of copper (II) sulphateby $Na_2S_2O_3$ using a standard $CuSO_4$ solution.	**4**
13.	Estimation of Aniline/phenol by bromination.	**4**
14.	Estimation of acetone by Iodination.	**4**
15.	Estimation of alkali content in anatacid tablet using HCl.	**4**
16.	Estimation of Aluminium (III) from the given aluminium salt solution by using Erichrome Black-T indicator	**4**
17.	Estimation of ethyl benzoate by hydrolysis	**4**
18.	Estimation of HCl by NaOH using a standard oxalic acid solution.	**4**
19.	Estimation of $KMnO_4$ by $Na_2S_2O_3$ using a standard $K_2Cr_2O_7$ solution.	**4**
20.	Estimation of Fe(II) by redox titration with $KMnO_4$	**4**
Study Resources	• Khopkar, S. M., (2008). Basic concepts of analytical chemistry. • Kamboj, P. C.,(2013). Systematic Practical Chemistry, 2nd Ed.Vishal Publication	

	• Mukhopadhyay, R., Chatterjee, P. (2016). Advanced Practical Chemistry, 2nd Ed Books and Allied Ltd. • An Advanced Chemistry In Practical Chemistry,New CentralBook Agency(P) Ltd. • Svehla G., (2002) Vogel's Qualitative Inorganic Analysis, Pearson Education. • Mendham, J.,Denny R. C., Barnes, Thomas,(2009)., Quantitative chemical analysis. • Bassett, Denney, Jeffrery, (1989). Vogel's text book of quantitative inorganic analysis. • Nemade, A. M. ,Zope, V. S.,Rajput A.P.,Gujrathi R.B,A Textbook of Practical Chemistry, Prashant Publications.	

S.Y. B.Sc. Chemistry (Open Elective)
Semester-IV
CHE-OE-241: Environment, Ecology and Climate change
Total Hours: 30 **Credits: 2**

Course objectives	• To study basics of environment and ecosystem. • To study the concept of biodiversity and its conservation. • To study climate changes. • To study environmental pollution, policies and practices.	
Course outcomes	After successful completion of this course, students are expected • To learn assessment of biodiversity. • To able to understand importance of biodiversity. • To able to develop basic knowledge of ecosystem. To able to describe effects of disturbances adaptation and development in ecosystem.	
Unit	**Contents**	**Hours**
Unit I	**Ecosystem** Concept Of System, Understanding The Ecosystem, Structural Aspects And Functional Aspects Of An Ecosystem, Energy Cycle, Food Chains', 'Food Web', 'Trophic Level' And 'Ecological Pyramid', Ecological Succession.	**8**
Unit II	**Biodiversity** Introduction To Biological Diversity, Genetic Diversity, Species Diversity, Ecosystem Diversity, Value Of Biodiversity, Commonly Used Modern Drugs Derived From Plant Sources, Endemic Species, Exotic Species.	**7**
Unit III	**Conservation of Biodeversity** Endemic Species And Their Regions, Conservation Of Biodiversity (I) In-Situ (II) Ex-Situ, Constitutional Provisions, Statutory Acts/Bodies, International Conferences/Protocols, Major Global Environmental Issues, Climate Change –A Brief	**7**
Unit IV	**Climate Change** A) Climate Change: Climate Change And Its Implications For India, Response To Climate Change, National Action Plan On Climate Change, B) Pollution: Categories, Causes, Types Of Particulates, International Conventions.	**8**
Study Resources	• Majid Husain. (2019), Environment and Ecology 5th Edition, GK publishers. • Ravi Agrahari (2023), Environment and Ecology- Biodiversity, climate Change and Disaster management. McGraw Hill.	

S.Y. B.Sc. Chemistry (Open Elective)
Semester-IV
CHE-OE-242: Introduction to Chemistry Laboratory

Total Hours: 60 **Credits: 02**

Course objectives	• Introduction to laboratory, glasswares and safety. • To understand the preparation of different buffer solution • To study to the purification techniques. • To study the different functional group. • To study the solubility behavior.	
Course Outcomes	By the end of the course students will be able to • Understand different combination of P^H and buffer solution. • To understand the purification techniques. • To understand the different functional groups. • Apply the concept of purification for product.	
Sr. No.	**Contents (Any 15)**	**Hours**
1	Introduction of the laboratory safety.	**4**
2	To know the knowledge about the basic glassware used in the laboratory.	**4**
3	To know the knowledge about the laboratory techniques of recrystallization.	**4**
4	To determine melting point of given sample (Naphthalene and Benzoic acid).	**4**
5	To determine boiling point of given sample (Benzaldehyde and Benzene).	**4**
6	To determine the solubility behavior of the given sample.	**4**
7	To determine the elements present in the given sample (Sulphur, Nitrogen, Carbon & Halogen)	**4**
8	One stage preparation.	**4**
9	To identify the functional group present in the given sample (Aldehydes and Ketones).	**4**
10	To identify the acid and base by litmus paper.	**4**
11	To determine P^H of some fruit juices.	**4**
12	To observe the variation in P^H of acid/base with dilution.	**4**
13	To detect the presence of adulterant in fat, oil or butter.	**4**
14	To detect the presence of adulterant in Sugar.	**4**
15	To detect the presence of adulterant in sample of chilli powder.	**4**
16	To detection of starch in milk.	**4**
17	To determine the casein present in milk.	**4**
18	To calculate the percentage of calcium present in egg shell.	**4**
19	Detection of presence of sugar in cold drinks.	**4**
20	Detection of P^H present in cold drinks.	**4**
Study Resources	1. Vogel A. I., "Elementary Practical Organic Chemistry", Part 2, Edition Two, 2004, CBS publishers & distributors, New Delhi, page no. 85. 2. Bansal R. K., "Laboratory Manual of Organic Chemistry" Edition Fourth, 2007, New Age International (P) Ltd., New Delhi, page no. 38.	

3. Brain S. Farnis, Antomy J. Hanward, smith W. G. Vogel's "Textbook of Practical Organic Chemistry", Edition Fifth, 2007, Dorling Kindersley (India) Pvt. Ltd., Delhi, 1000 - 1290.
4. Rawal J. H., Baldhania S.A., "Practical in organic chemistry" Nirav prakashn pvt. Ltd., Delhi., page no. 273.
5. Ahluwalia V.K., "Green chemistry environmentally", Edition first, Published by A. N Books pvt. Ltd., page no. 155.
6. Cohnn J. B., "A class of organic chemistry" Nirav prakashn pvt. Ltd., page no. 295, 1918.
7. Mann F. J, Sunders B.C. "Practical of Organic Chemistry", Edition fourth, 2007, Dorling Kindersley (India) Pvt. Ltd., Delhi 2009, page no. 210 - 330.
8. Saluja M.P., "Pharmaceutical chemistry -II" Edition Second, 2019, Krishna's Educational Publishers Pvt. Ltd., Meerut, page no. 51-80.
9. Ahluwalia V.K., "College practical Chemistry", Edition first, Published by university press (India) pvt. Ltd. 2005, page no. 155 - 250. 10. Bansal R.K, "Laboratory manual of organic chemistry", page no. 111
10. A.V. Reddy, K.K. Swain, K. Venkatesh., "Experiments in Analytical Chemistry"
11. Laboratory Manual Chemistry by NCERT.
12. Detection of adulteration in common food stuff, Tanmay jyoti Deka.

S.Y. B.Sc. Chemistry (Major)
Semester-IV
CHE-FP-241: Field Projects

Total Hours: 60 **Credits: 02**

Objectives

- To provide students with practical exposure in rural and urban socioeconomic context.
- To develop students abilities to apply subject knowledge to address real world problems
- To foster critical thinking and innovative approaches to solve socioeconomic issues.

Outcomes

After completing this course, students will be able to

- Participateactively in filed projects that benefit local communities and promote sustainable development practices.
- Analyse the socio economic data using appropriate methods showcasing improved problem-solving skills, technical proficiency.
- Demonstrate the ability to apply theoretical knowledge to real-world situations effectively and exhibit communication skills.

Course structure

The course is divided in to four probable phases

I] Orientation and preparation

- Introduce to the course, objectives and expectation
- Overview of socioeconomic development issues in rural and urban context
- Training on working methodology and data collection techniques
- Review existing literature related to topic to understand the background and context.

II] Workplanand Field visit

- Visit the potential sites to get a sense of the environment and logistical requirements.
- Create a detailed project plan outlining the steps, timeline, resources needed, and roles of team members.
- Obtain necessary approvals (Ethical/ local authorities/organizations/communities)
- Gather materials and resources (recording devices, cameras, notebooks and supplies)
- Conduct Preliminary Survey, choose appropriate methods for data collection and analysis (e.g., surveys, interviews, observations).

III] Data collection and analysis

- Pilot test to identify issues with data collection.
- Collect data systematically, ensuring consistency and accuracy.
- Keep detailed records of all data (field notes, recordings, photographs etc)
- Organize and analyse the data (manual/ software)

IV] Interpretation and Reporting

- Interpret your findings in the context to objectives.
- Write and submit a comprehensive report detailing your methodology, findings, analysis, and conclusions. (Include visuals - charts, graphs, and photographs).
- Prepare a presentation to share findings with peers/ instructors/ community.

Assessment

- Field work participation, field note book, team work etc. (10 Marks)
- Data Collection and Analysis (15 Marks)

- Field project report (15 Marks)
- Presentation of Findings(10 Marks)

Examples of activities to be conducted under field projects

- **Biodiversity Survey**: Conduct a biodiversity survey in a local park or nature reserve, documenting plant and animal species.
- **Water Quality Testing**: Test water samples from different sources (e.g., rivers, lakes, groundwater) for pollutants and compare results.
- **Soil Analysis**: Collect soil samples from various locations and analyse their composition and quality.
- **Wildlife Tracking**: Use camera traps or tracking devices to monitor and study the behaviour of local wildlife.
- **Urban Heat Island Effect**: Measure and map temperature differences in various parts of a city.
- **Land Use Mapping**: Create maps showing different land uses in a region and analyze changes over time.
- **Cultural Heritage Documentation**: Document and analyze local cultural heritage sites or practices.
- **Community Interviews**: Conduct interviews with community members to understand social dynamics and traditions.
- **Ethnographic Study**: Participate in and observe community events to gather ethnographic data.
- **Crop Yield Analysis**: Study the factors affecting crop yield in different fields or under different farming practices.
- **Pest Management**: Investigate the effectiveness of various pest management techniques in local farms.
- **Sustainable Farming Practices**: Evaluate the impact of sustainable farming practices on soil health and crop productivity.
- **Community Needs Assessment**: Conduct surveys and interviews to identify the needs and concerns of a community.
- **Social Network Analysis**: Study the social networks within a community to understand relationships and influence.
- **Public Health Study**: Investigate public health issues in a community, such as access to healthcare or prevalence of diseases.
- **Infrastructure Survey**: Assess the condition and effectiveness of local infrastructure, such as roads, bridges, and buildings.
- **Renewable Energy Potential**: Evaluate the potential for renewable energy sources (e.g., solar, wind) in a specific area.
- **Water Management**: Study and improve local water management systems, including irrigation and drainage.
- **Literacy Program Evaluation**: Evaluate the effectiveness of local literacy programs and suggest improvements.
- **Educational Resource Assessment**: Assess the availability and quality of educational resources in local schools.
- **Market Analysis**: Conduct a market analysis for a local business or industry.
- **Entrepreneurship Project**: Develop a business plan for a local entrepreneurial venture
- **Local History Documentation**: Research and document the history of a local site, building, or community.
- **Oral History Project**: Conduct interviews with local residents to collect oral histories and preserve community memories.

- **Archival Research**: Explore local archives to uncover historical documents and artifacts related to a specific topic or period.
- **Community Mural**: Design and create a mural in collaboration with community members that reflects local culture and history.
- **Public Art Installation**: Develop and install a public art project that engages the local community.
- **Art Exhibit Curation**: Curate an exhibit featuring works by local artists, highlighting themes relevant to the community.
- **Music Documentation**: Record and document traditional or contemporary music from the local area.
- **Community Concerts**: Organize and perform in community concerts that showcase local musical talent.
- **Community Theatre Production**: Develop and produce a play that involves community members as actors and crew.
- **Site-Specific Theatre**: Create a theatrical performance that takes place in a non-traditional venue, such as a historic site or public space.
- **Cultural Mapping**: Map cultural resources and heritage sites within the community and analyze their significance.
- **Festival Documentation**: Document and analyze local festivals or cultural events, exploring their history and impact.
- **Ethnographic Study**: Conduct an ethnographic study of a particular cultural practice or community group.
- **Public Philosophy Discussions**: Organize and facilitate public discussions on philosophical topics relevant to the community.
- **Community Documentary**: Create a documentary film about a local issue, event, or group.
- **Digital Storytelling**: Develop digital storytelling projects that capture and share local stories.
- **Language Survey**: Conduct a survey of languages spoken in the community and analyze patterns of language use and change.
- **Dialect Study**: Study and document local dialects or accents, exploring their features and origins.
- **Language Preservation**: Work with community members to document and preserve endangered languages or dialects.
- **Gentrification Impact Study**: Examine the effects of gentrification on local communities, including displacement and economic changes.
- **Crime and Safety Analysis**: Study crime patterns and perceptions of safety within a community.
- **Ritual and Festival Study**: Participate in and document local rituals or festivals to understand their social and cultural significance.
- **Migration Patterns Study**: Analyze migration patterns and their effects on both the sending and receiving communities.
- **Food and Culture Study**: Investigate the role of food in cultural practices and social interactions within a community.
- **Local Governance Analysis**: Study the structure and functioning of local government and its impact on the community.
- **Political Participation Study**: Analyze patterns of political participation and engagement within a community.
- **Public Policy Impact Assessment**: Evaluate the impact of specific public policies on local communities.
- **Election Study**: Analyze voting behavior and patterns in local elections.
- **Mental Health Survey**: Conduct surveys to assess the mental health needs and resources in a community.

- **Social Behavior Observation**: Observe and analyze social behaviors in public spaces, such as parks or markets.
- **Stress and Coping Study**: Investigate sources of stress and coping mechanisms within a community.
- **Community Support Systems**: Study the role and effectiveness of community support systems and networks.
- **Youth Development Programs**: Evaluate the impact of youth development programs on community wellbeing.
- **Educational Equity Study**: Assess disparities in educational resources and outcomes in local schools.
- **Parent and Teacher Interviews**: Conduct interviews to understand perceptions of educational quality and challenges.
- **After-School Program Evaluation**: Evaluate the effectiveness of after-school programs in supporting student development.
- **Educational Attainment Study**: Analyze factors influencing educational attainment in a community.
- **Local Economy Analysis**: Study the structure and dynamics of the local economy, including key industries and employment patterns.
- **Small Business Survey**: Conduct surveys of local small businesses to understand their challenges and successes.
- **Economic Impact of Events**: Analyze the economic impact of local events or festivals on the community.
- **Income Inequality Study**: Investigate patterns and causes of income inequality within a community.
- **Housing Affordability Analysis**: Study housing affordability issues and their impact on residents.
- **Gender Roles and Expectations**: Study gender roles and expectations within a community and their impact on individuals.
- **Women's Health Study**: Investigate issues related to women's health and access to healthcare.
- **Gender-Based Violence Survey**: Conduct surveys to understand the prevalence and impact of gender-based violence.
- **Workplace Equality Study**: Analyze gender equality in local workplaces, including pay equity and job opportunities.
- **Urban Development Projects**: Study the impact of urban development projects on local communities.
- **Public Space Usage**: Analyze how public spaces are used and perceived by different community members.
- **Transportation Study**: Investigate transportation needs and challenges within a community.
- **Green Space Analysis**: Study the availability and usage of green spaces in urban areas and their impact on residents.