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 :- 01/08/2023

NOTIFICATION

Sub :- CBCS Syllabi of B. Sc. in Chemistry (Sem. I & II)

Ref. :- Decision of the Academic Council at its meeting held on 26/07/2023.

The Syllabi of B. Sc. in Chemistry (First and Second Semesters) as per **NATIONAL EDUCATION POLICY - 2020** and approved by the Academic Council as referred above are hereby notified for implementation with effect from the academic year 2023-24.

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

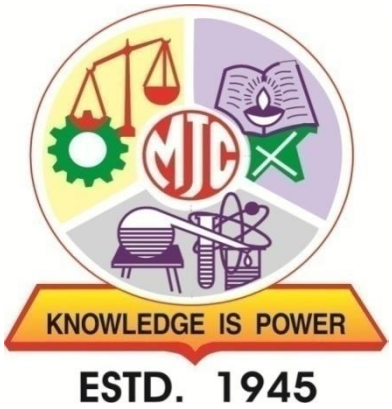
Moolji Jaitha College, Jalgaon

An "Autonomous College"

Affiliated to

Kavayitri Bahinabai Chaudhari

North Maharashtra University, Jalgaon-425001



STRUCTURE AND SYLLABUS

B.Sc. Honours/Honours with Research

F.Y.B. Sc. Chemistry

Under Choice Based Credit System (CBCS)

and

as per NEP-2020 Guidelines

[w.e.f. Academic Year: 2023-24]

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 learning 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. Chemistry Honours/Honours with Research:

Upon successful completion of the B.Sc. program, student will be able to:

PO No.	PO
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 engage in continuous learning, adapt to new technologies and advancements in their field, and stay updated with current research.

Programme Specific Outcome (PSO) for B.Sc. Chemistry Honours/Honours with Research:

After completion of this course, students are expected to:

PSO No.	PSO
1	understand the theoretical concepts of organic chemistry such as IUPAC nomenclature, electronic effects, reactive intermediates, organic reagents, types of reactions and their mechanisms etc. Along with this students will also learn practical aspects of organic chemistry such as purification techniques, qualitative analysis, organic synthesis etc.
2	understand the different concept of inorganic chemistry such as elements and their different periodic properties, chemical bonding, coordination complexes, catalysis etc. Along with this students will also learn practical inorganic techniques such as inorganic qualitative and quantitative analysis, coordination complex synthesis etc.
3	learn various concepts of physical chemistry, namely, as it is through thermodynamics, chemical

	kinetics, electrochemistry, quantum chemistry, solid state chemistry, colligative properties, nuclear chemistry and radioactivity etc.
4	learn contemporary as well as modern concepts of chemistry such as nanochemistry, polymer chemistry, green chemistry, environmental chemistry etc.
5	apply their chemistry knowledge and critical thinking to design, perform, record, analyze, to assess environmental impact etc. of chemical reactions.
6	use its knowledge of chemistry in various field such as pharmaceuticals, fine chemicals, teaching, research, environmental monitoring, food products, cosmetics industry etc. in their career.

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

Leve1	Sem	Major (Core) Subjects		Minor Subjects (MIN)	GE/ OE	VSC, SEC (VESC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int, RP	Cumulative Credits/Sem	Degree/ Cumulative Cr.
		Mandatory (DSC)	Elective (DSE)							
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 44
	II	DSC-4 (2T) DSC-5 (2T) (IKS) 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	4+4+2	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.										
5.0	III	DSC-7 (2T) DSC-8 (2T) DSC-9 (2P) DSC-10 (2P)	...	MIN-5 (2T) MIN-6 (2P)	OE-3 (2T) OE-4 (2P)		AEC-3 (2T) (MIL)	CC-3 (2) CEP (2)	22	UG Diploma 88
	IV	DSC-11 (2T) DSC-12 (2T) DSC-13 (2P) DSC-14 (2P)	...	MIN-7 (2T) MIN-8 (2P)	OE- 5 (2T) OE-6 (2P)		AEC-4 (2T) (MIL)	CC-4 (2) FP (2)	22	
	Cum Cr	28	...	16	10	6	8+4+2	8+2+2	88	
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 and Minor.										
5.5	V	DSC-15 (2T) DSC-16 (2T) DSC-17 (2T) DSC-18 (2P) DSC-19 (2P)	DSE-1 (2T) A/B DSE-2 (2P) A/B	MIN-9 (2T/P)	...	VSC-1 (2T) VSC-2 (2P)	...	OJT/Int(2)	22	UG Degree 132
	VI	DSC-20 (2T) DSC-21 (2T) DSC-22 (2T) DSC-23 (2P) DSC-24 (2P)	DSE-3 (2T) A/B DSE-4 (2P) A/B	MIN-10(2T/P)	—	VSC-3 (2T) VSC-4 (2P)	...	OJT/Int(2)	22	
	Cum. Cr.	48	08	20	10	8+6	8+4+2	8+2+2+4	132	
Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor										
6.0	VII	DSC-25 (4T) DSC-26 (4T) DSC-28 (4T) DSC-27 (2P)	DSE-5 (2T) A/B DSE-6(2P) A/B	RM (4T)	—	...	...		22	UG Honors Degree 176
	VIII	DSC-29 (4T) DSC-30 (4T) DSC-32 (4T) DSC-31 (2P)	DSE-7 (2T) A/B DSE-8(2P) A/B		—	...	...	OJT/Int (4)	22	
	Cum. Cr.	76	16	20+4	10	8+6	8+4+2	8+2+2+8	176	
Four Year UG Honors Degree in Major and Minor with 176 credits										
6.0	VII	DSC-25 (4T) DSC-26 (4T) DSC-27 (2P)	DSE-5 (2T) A/B DSE-6 (2P) A/B	RM (4T)	...	...	...	RP (4)	22	UG Honors with Research Degree 176
	VIII	DSC-29 (4T) DSC-30 (4T) DSC-31 (2P)	DSE-7 (2T) A/B DSE-8 (2P) A/B		...	...	...	RP (8)	22	
	Cum. Cr.	68	16	20+4	10	8+6	8+4+2	8+2+2+8+12	176	
Four Year UG Honours with Research Degree in Major and Minor with 176 credits										

Sem- Semester, **DSC**- Department Specific Course, **DSE**- Department Specific Elective, **T**- Theory, **P**- Practical, CC- Cocurricular **RM**- Research Methodology, **OJT**- On Job Training, **FP**- Field Project, **Int**- Internship, **RP**- Research Project.

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

F. Y. B. Sc. Chemistry Course Structure

Semester	Course Module	Credit	Hours/ week	TH/ PR	Code	Title
I	DSC	2	2	TH	CHE-DSC-111	Fundamentals of Inorganic Chemistry
	DSC	2	2	TH	CHE-DSC-112	Fundamentals of Organic Chemistry
	DSC	2	4	PR	CHE-DSC-113	Practicals in Organic and Inorganic Chemistry
	MIN	2	2	TH	CHE-MIN-111	Elemental Chemistry
	MIN	2	4	PR	CHE-MIN-112	Practicals in Chemistry
	OE/GE	2	2	TH	CHE-GE-111	Chemistry in Everyday Life
	SEC	2	2	TH	CHE-SEC-111	Basic Computer Skills in Chemistry
	SEC	1	2	PR	CHE-SEC-112	Preparations and Standardizations of Solutions
	AEC	2	2	TH	ENGS-AEC-111	English
	VEC	2	2	TH	ES -VEC-111	Environmental Studies
	IKS	1	1	TH	IKS-111	Indian knowledge system
	CC	2	2	CC	NCC-CC-111 NSS-CC-111 SPT-CC-111 CUL-CC-111	NCC NSS Sports Cultural
II	DSC	2	2	TH	CHE-DSC-121	Fundamentals of Physical Chemistry
	DSC	2	2	TH	CHE-DSC-122	Chemistry of Functional Groups
	DSC	2	4	PR	CHE-DSC-123	Practicals in Physical and Organic Chemistry
	MIN	2	2	TH	CHE-MIN-121	Introduction to Carbon Compounds
	MIN	2	4	PR	CHE-MIN-122	Basic Practicals in Chemistry
	OE/GE	2	2	TH	CHE-GE-121	Health and Nutrition
	SEC	2	2	TH	CHE-SEC-121	Basic Analytical Chemistry
	SEC	1	2	PR	CHE-SEC-122	Practicals of Food Adulteration
	AEC	2	2	TH	ENGS-AEC-121	English
	VEC	2	2	TH	CI-VEC-121	Constitution of India
	IKS	1	1	TH	IKS-121	Indian Knowledge System
	CC	2	2	CC	NCC-CC-121 NSS-CC-121 SPT-CC-121 CUL-CC-121	NCC NSS Sports Cultural

DSC : Department-Specific Core course
DSE : Department-Specific elective
GE/OE : Generic/ Open elective
SEC : Skill Enhancement Course
MIN : Minor course
AEC : Ability Enhancement Course
VEC : Value Education Courses

ENG : English
ES : Environmental studies
CI : Constitution of India
IKS : Indian Knowledge System
CC : Co-curricular course
TH : Theory
PR : Practical

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. while 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 condition is 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.

Semester-I

F. Y. B. Sc
Semester-I
CHE-DSC-111: Fundamentals of Inorganic Chemistry

Total Hours: 30 **Credits: 2**

Course objectives	• To study atomic structure. • To study periodic table and classifications of elements. • To study the general properties of s and p block elements. • To study the applications of s and p block elements.	
Course outcomes	After successful completion of this course, students are expected to • understand the structure of an atom. • learn periodic table and classification of elements. • apply the concepts of periodic properties. • learn applications of s and p block elements.	
Unit	**Contents**	**Hours**
Unit I	**Atomic Structure** Rutherford's α-particle scattering experiment, Rutherford's nuclear model of an atom, electromagnetic radiations, postulates of Bohr's atomic model and its limitations, orbit and orbitals, shapes of orbitals, difference between orbit and orbital, quantum numbers, shielding effect and effective nuclear charge, and rules for writing electronic configuration.	**8**
Unit II	**Periodic Table** Mendeleef's periodic table and its limitations, Modern periodic table and its superiority over Mendeleef's periodic table, Periodicity of property and its cause , magic numbers, classification of elements (s, p, d, and f block), periodic properties and factors affecting on it: atomic size, covalent radius, ionisation energy, electron affinity, electronegativity, and metallic character.	**7**
Unit III	**s-Block Elements** General Characteristics, Electronic configuration, Atomic and ionic radii, Ionisation Energy, Electron affinity, Electronegativity, Metallic (electropositive) character, Density in solid state, Atomic volumes, Melting and boiling points, Electrode potential, oxidising and reducing properties in aqueous solution, Diagonal relationship, and Anomalous behaviour.	**8**
Unit IV	**p-Block Elements** General Characteristics: Electronic configuration, Atomic and ionic radii, Ionisation Energy, Electron affinity, Electronegativity, Non-Metallic (electronegative) character, Density in solid state, Atomic volumes, Melting & boiling points, Electrode potential, oxidising & reducing properties in aqueous solution, Diagonal relationship and knight move relationship, Reluctance of heavier elements to form (p-p) π-bonds. Applications of p-block elements.	**7**
Study Resources	• Lee J. D., (2015). Concise Inorganic Chemistry, 5th Ed.,Wiley India(P.), New Delhi. • Sodhi G. S., (2018). Principles of Inorganic Chemistry, 3rd Ed., Vinod Vasishtha for Viva Books Private Limited, New Delhi. • Satya P., Tuli G. D., Basu S. K., Madan R. D., (2012). Advanced Inorganic Chemistry Vol-1, 1st Ed., S. Chand and Company Ltd., New	

	Delhi. • Puri B. R., Sharma L. R., Kalia K. C., (2006). Principles of Inorganic Chemistry, 3rd Ed., Milestone Publisher, Delhi. • Cotton, F. A., Wilkinson, G., Murillo C. A., Bochmann M., (1990) Advanced Inorganic Chemistry, 6th Ed., John Wiley and Sons, Inc. • Huheey, J. E., Keiter E. A., Keiter R. L., (1993). Inorganic Chemistry Principles of Structures and Reactivity, 4th Ed., Harper Collins College Publishers, New York. • Atkins, P., Overton, T., Rourke, J., Weller M., Armstrong F., (2010). Inorganic Chemistry, 5th Ed. (South Asia Edition), W. H. Oxford University Press.	

F. Y. B. Sc
Semester-I
CHE-DSC-112: Fundamentals of Organic Chemistry

Total Hours: 30 **Credits: 2**

Course objectives	• To study fundamentals of organic chemistry. • To learn the IUPAC nomenclature. • To study the chemistry of hydrocarbons. • To study the chemistry of aromatic hydrocarbons.	
Course outcomes	After successful completion of this course, students are expected to • understand electronic and structural effect in organic molecules. • apply the concept of IUPAC nomenclature to give name to the compounds. • learn preparation and reactions of hydrocarbons. • learn preparation and reactions of aromatic hydrocarbons.	
Unit	**Contents**	**Hours**
Unit I	**Fundamentals of Organic Chemistry** Introduction, electronegativity, organic chemistry and periodic table, Chemical Bonding: Chemical bond, covalent and ionic bond, bonding in organic molecules, Drawing of molecules (Types of structure): Complete structural formula, condensed structural formula, bond line structural formula and Wedge-Dash formula. Electronic Effects: Inductive effect, Resonance, Hyperconjugation and Tautomerism. Terms related to organic reactions: Substrate, reagent, catalyst, nucleophile and electrophile. Applications of Organic Chemistry.	**8**
Unit II	**IUPAC Nomenclature** Rules for IUPAC nomenclature of hydrocarbons: Saturated hydrocarbons (alkanes), and unsaturated hydrocarbons (alkenes and alkynes). Organic compounds containing one functional group: Alcohols, ether, aldehydes, ketone, carboxylic acid, ester, amines, amide, and nitrile. Organic compounds containing functional group and multiple bonds. Organic compounds containing two or more than two functional groups. Cyclic organic compounds. Bicyclic organic compounds, Spiro compounds, and Aromatic compounds.	**7**
Unit III	**Aliphatic Hydrocarbons** Alkanes: Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, and from Grignard reagent. Reactions: Free radical substitution (Halogenation). Alkenes: Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule). Partial catalytic hydrogenation (cis alkenes) and Birch reduction (trans alkenes). Reactions: Addition of alk. KMnO4 (cis-addition), liquid bromine (trans-addition), Markownikoff's and anti-Markownikoff's addition (Addition of HX). Alkynes: Preparation: Acetylene from CaC_2 and conversion into higher alkynes; and by dehalogenation of tetra halides. Reactions: formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, and oxidation with hot alkaline $KMnO_4$.	**8**
Unit IV	**Aromatic Hydrocarbons** Aromaticity: Hückel's rule. Preparation (benzene): from phenol, by decarboxylation of benzoic acid, and from acetylene. Reactions: (benzene): Electrophilic substitution: Nitration, halogenation, sulphonation, and Friedel-Craft's reaction (alkylation and acylation).	**7**

Study Resources	• Clayden, J., Greeves, N., and Warren, S. (2012). Organic Chemistry. Oxford University Press, USA. • Smith, M. B. (2020). March's Advanced Organic Chemistry: Reactions, Mechanisms, And Structure. John Wiley & Sons. • Chauhan, M. S (2019). Solomons, Fryhle, Snyder, Organic Chemistry for JEE (Mains and Advanced). John Wiley & Sons. • Madan, R. L. (2022). Chemistry for Degree Students B. Sc. First Year (LPSPE). S. Chand Publishing. • Morrison, R., and Morrison, B. (1983). Boyd organic chemistry. Boston: Allen and Bacon.	

F. Y. B. Sc
Semester-I
CHE-DSC-113: Practicals in Organic and Inorganic Chemistry

Total Hours: 60 **Credits: 2**

Course objectives	• To study organic preparations. • To study procedure of molecular weight determination. • To study the inorganic preparations. • To study dietary contents in foods.	
Course Outcomes	After successful completion of this course, students are expected to • understand preparation of organic compounds. • to apply the knowledge of molecular weight determination. • understand structure of inorganic complexes. • apply knowledge of food analysis in daily life.	
Sr. No.	**Contents (Any 15)**	**Hours**
1	Aldol condensation using conventional or green method.	**4**
2	Preparation of iodoform from acetone or ethyl alcohol	**4**
3	To prepare acetanilide from aniline.	**4**
4	To prepare p-nitro acetanilide from acetanilide.	**4**
5	To prepare benzoic acid from benzamide/benzaldehyde	**4**
6	To study the saponification reaction of soap.	**4**
7	To determine melting point of given organic compounds.	**4**
8	To determine boiling point of given organic compounds.	**4**
9	To determine casein present in different samples of milk.	**4**
10	To detect carbohydrates, fats, proteins in given food sample.	**4**
11	Purification of organic compound by recrystalization.	**4**
12	To prepare crystals of potash alum (Phitkari) [$K_2SO_4.Al_2(SO_4)_3.24H_2O$].	**4**
13	To prepare crystals of ferrous ammonium sulphate(Mohr's Salt)[$FeSO_4.(NH_4)_2SO_4.6H_2O$].	**4**
14	To prepare crystals of Potassium Ferric Oxalate.	**4**
15	To prepare a standard N/20 copper sulphate solution and then determine the strength of sodium thiosulphate solution iodometrically	**4**
16	Determine the concentration of Ca^{2+} ions by EDTA using EriochromeBlack –T as indicator	**4**
17	To determine the molarity and strength of given $KMnO_4$ solution using Mohr's salt (M/20).	**4**
18	To estimate free alkali present in different soaps/detergents	**4**
19	To determine molecular weight of monobasic/dibasic acid by volumetric method	**4**
20	To determine water of crystallization of given salt gravimetrically ($BaCl_2.2H20/MgSO_4.7H_20$)	**4**
Study Resources	• Svehla, G. (2012). Vogel's Qualitative Inorganic Analysis, Pearson Education Limited, New Delhi. • Mendham, J. (2009). Vogel's Quantitative Chemical Analysis, 6th edition, 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 edition Textbookof Prentice-Hall. • Mann, F. G., Saunders, B. C., (1960). Practical Organic Chemistry, 4th edition, New Delhi Orient Longman. • Madan, R. L. (2023). Chemistry for B. Sc. Students, Analytical and Orgainc Chemistry-I, 1st edition, S. Chand and Company Limited, New Delhi.	

F. Y. B. Sc
Semester-I
CHE-MIN-111: Elemental Chemistry

Total Hours: 30 **Credits: 2**

Course objectives	• To study atomic structure. • To study periodic table and classifications of elements. • To study the general properties of s and p block elements. • To study the applications of s and p block elements.	
Course outcomes	After successful completion of this course, students are expected to • understand the structure of an atom. • learn periodic table and classification of elements. • apply the concepts of periodic properties. • learn applications of s and p block elements.	
Unit	**Contents**	**Hours**
Unit I	**Atomic Structure** Rutherford's α-particle scattering experiment, Rutherford's nuclear model of an atom, electromagnetic radiations, postulates of Bohr's atomic model and its limitations, orbit and orbitals, shapes of orbitals, difference between orbit and orbital, quantum numbers, shielding effect and effective nuclear charge, and rules for writing electronic configuration.	**8**
Unit II	**Periodic Table** Mendeleef's periodic table and its limitations, Modern periodic table and its superiority over Mendeleef's periodic table, Periodicity of property and its cause , magic numbers, classification of elements (s, p, d, and f block), periodic properties and factors affecting on it: atomic size, covalent radius, ionisation energy, electron affinity, electronegativity, and metallic character.	**7**
Unit III	**s-Block Elements** General Characteristics, Electronic configuration, Atomic and ionic radii, Ionisation Energy, Electron affinity, Electronegativity, Metallic (electropositive) character, Density in solid state, Atomic volumes, Melting and boiling points, Electrode potential, oxidising and reducing properties in aqueous solution, Diagonal relationship, and Anomalous behaviour.	**8**
Unit IV	**p-Block Elements** General Characteristics: Electronic configuration, Atomic and ionic radii, Ionisation Energy, Electron affinity, Electronegativity, Non-Metallic (electronegative) character, Density in solid state, Atomic volumes, Melting & boiling points, Electrode potential, oxidising & reducing properties in aqueous solution, Diagonal relationship and knight move relationship, Reluctance of heavier elements to form (p-p) π-bonds. Applications of p-block elements.	**7**
Study Resources	• Lee J. D., (2015). Concise Inorganic Chemistry, 5th Ed.,Wiley India(P.), New Delhi. • Sodhi G. S., (2018). Principles of Inorganic Chemistry, 3rd Ed., Vinod Vasishtha for Viva Books Private Limited, New Delhi. • Satya P., Tuli G. D., Basu S. K., Madan R. D., (2012). Advanced Inorganic Chemistry Vol-1, 1st Ed., S. Chand and Company Ltd., New Delhi.	

	• Puri B. R., Sharma L. R., Kalia K. C., (2006). Principles of Inorganic Chemistry, 3rd Ed., Milestone Publisher, Delhi. • Cotton, F. A., Wilkinson, G., Murillo C. A., Bochmann M., (1990) Advanced Inorganic Chemistry, 6th Ed., John Wiley and Sons, Inc. • Huheey, J. E., Keiter E. A., Keiter R. L., (1993). Inorganic Chemistry Principles of Structures and Reactivity, 4th Ed., Harper Collins College Publishers, New York. • Atkins, P., Overton, T., Rourke, J., Weller M., Armstrong F., (2010). Inorganic Chemistry, 5Th Ed. .(South Asia Edition), W.H. Oxford University Press.	

F. Y. B. Sc
Semester-I
CHE-MIN-112: Practicals in Chemistry

Total Hours: 60 **Credits: 2**

Course objectives	• To study organic preparations. • To study the of procedure of molecular determination. • To study the inorganic preparations. • To study dietary contents in foods.	
Course Outcomes	After successful completion of this course, students are expected to • understand preparation of organic compounds. • apply the knowledge of molecular weight determination. • understand structure of inorganic complexes. • apply knowledge of food analysis in daily life.	
Sr. No.	**Contents (Any 15)**	**Hours**
1	Aldol condensation using conventional or green method.	**4**
2	Preparation of iodoform from acetone or ethyl alcohol	**4**
3	To prepare acetanilide from aniline.	**4**
4	To prepare p-nitro acetanilide from acetanilide.	**4**
5	To prepare benzoic acid from benzamide/benzaldehyde	**4**
6	To study the saponification reaction of soap.	**4**
7	To determine melting point of given organic compounds.	**4**
8	To determine boiling point of given organic compounds.	**4**
9	To determine casein present in different samples of milk.	**4**
10	To detect carbohydrates, fats, proteins in given food sample.	**4**
11	Purification of organic compound by recrystalization.	**4**
12	To prepare crystals of potash alum (Phitkari) [$K_2SO_4.Al_2(SO_4)_3.24 H_2O$].	**4**
13	To prepare crystals of ferrous ammonium sulphate(Mohr's Salt)[$FeSO_4.(NH_4)_2SO_4.6H_2O$].	**4**
14	To prepare crystals of Potassium Ferric Oxalate.	**4**
15	To prepare a standard N/20 copper sulphate solution and then determine the strength of sodium thiosulphate solution iodometrically	**4**
16	Determine the concentration of Ca^{2+} ions by EDTA using Eriochrome Black –T as indicator	**4**
17	To determine the molarity and strength of given $KMnO_4$ solution using Mohr's salt (M/20).	**4**
18	To estimate free alkali present in different soaps/detergents	**4**
19	To determine molecular weight of monobasic/dibasic acid by volumetric method	**4**
20	To determine water of crystallization of given salt gravimetrically ($BaCl_2.2H20/MgSO_4.7H_20$)	**4**

Study Resources	• Svehla, G. (2012). Vogel's Qualitative Inorganic Analysis, Pearson Education Limited, New Delhi. • Mendham, J. (2009). Vogel's Quantitative Chemical Analysis, 6th edition, 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 edition Textbookof Prentice-Hall. • Mann, F. G., Saunders, B. C., (1960). Practical Organic Chemistry, 4th edition, New Delhi Orient Longman. • Madan, R. L. (2023). Chemistry for B. Sc. Students, Analytical and Orgainc Chemistry-I, 1st edition, S. Chand and Company Limited, New Delhi.	

F. Y. B. Sc
Semester-I
CHE-GE-111: Chemistry in Everyday Life

Total Hours: 30 **Credits: 2**

Course objectives	• To understand the relation of chemistry to day to day activities. • To scientifically understand the daily life experiences. • To study the role of chemistry in the kitchen, laundry, garden. • To be aware of the importance of chemistry in our atmosphere**.**	
Course outcomes	After successful completion of this course, students are expected to • apply the knowledge of chemistry in everyday chores. • verify the facts based on chemistry. • seek answers to queries such as the effect of detergent, food preservatives etc. • be aware of the harmful effects of excessive pesticides and global warming.	
Unit	**Contents**	**Hours**
Unit I	**Chemistry in the Kitchen** Butter and cooking oil - saturated and unsaturated fatty acids, hydrogenation of oil. Chemistry of cooking - physical and chemical changes, stability of nutrients during cooking. Microwave cooking. Food sterilization and preservation.	**8**
Unit II	**Chemistry in the Laundry** Soaps. Synthetic surfactants and their mode of actions. Laundry detergents - organic and inorganic builders, inert fillers, foam. Bleach - chlorine, sodium perborate. Washing in machines - solid and liquid laundry detergents - compositions, surfactants and their potentiation.	**7**
Unit III	**Chemistry in the Garden** Food for plants, nutrient deficiencies in plants. Fertilizers, composting, pesticides and their toxicities. Insecticides, fungicides. Biological control of weeds and pests.	**8**
Unit IV	**Chemistry in the atmosphere** Pollution. Acid rain. Ozone layer. Global warming. Green chemistry. Relevant international conventions.	**7**
Study Resources	• Selinger, B., Chemistry in the Marketplace (5th ed.) (1998). Harcourt Brace • Karukstis, K. K., and Van Hecke, G. R. (2003). Chemistry Connections: The chemical basis of everyday phenomena. Elsevier. • Atkins, P. W. (2003). Atkins' molecules. Cambridge University Press. • LuningPrak, D. J., and Copper, C. L. (2008). A chemistry minute: recognizing chemistry in our daily lives. Journal of chemical education, 85(10), 1368. • Moy, C. L., Locke, J. R., Coppola, B. P., and McNeil, A. J. (2010). Improving science education and understanding through editing Wikipedia. Journal of chemical education, 87(11), 1159-1162.	

F. Y. B. Sc
Semester-I
CHE-SEC-111: Basic Computer Skills in Chemistry

Total Hours: 30 **Credits: 2**

Course objectives	• To learn MS Word applications and different chemical software. • To learn skill of numeric data handing. • To acquire the knowledge of statistical analysis. • To acquire the knowledge of numerical modelling.	
Course outcomes	After successful completion of this course, students are expected to • successfully use MS Word to prepare documents. • use chemical software to draw chemical structures/reactions, name the compound etc. • be well versed with the knowledge of numerical data handling. • get the skill of statistical analysis of obtained experimental analysis.	
Unit	**Contents**	**Hours**
Unit I	**Introductory Writing Activities** Word Processing: Definition and applications. Introduction to Microsoft Word. Formatting the Document. Power point: Introduction, basics and its applications.	**8**
Unit II	**Chemical Softwares** Chemical structure drawing (Chem Sketch/ Chem Draw/ISI draw) software. Incorporating chemical structures, chemical equations, and expressions from chemistry into word processing documents. **Origin Lab:** Introduction and applications.	**7**
Unit III	**Handling Numeric Data** Spreadsheet software (Excel), creating a spreadsheet, entering and formatting information, basic functions and formulae, creating charts, tables and graphs. Incorporating tables and graphs into word processing documents. Simple calculations, plotting graphs using a spreadsheet. Graphical solution.	**8**
Unit IV	**Numeric Modelling** Simulation. Excel functions LINEST and Least Squares. Numerical curve fitting, linear regression (rate constants from concentration time data, molar extinction coefficients from absorbance data), numerical differentiation (e.g. handling data from potentiometric and pH metric titrations, pKa of weak acid), integration(e.g. entropy/enthalpy change from heat capacity data).	**7**
Study Resources	• De Levie, R. (2001). How to Use Excel® in Analytical Chemistry and in General Scientific Data Analysis. Cambridge University Press. • Noggle., J. H., (1985). Physical chemistry on a Microcomputer. Little Brown & Co. • Venit, S. M., (1996). Programming in BASIC: Problem solving with structure and style. Jaico Publishing House: Delhi. • Li Z.,Wan H., Shi Y. and Ouyang P. (2004). Personal experience with four kinds of chemical structure drawing software: review on ChemDraw, ChemWindow, ISIS/Draw, and ChemSketch. Journal of Chemical Information and Computer Sciences, 44(5), 1886-1890. • Cousins, K. R., (2011). Computer review of chemdraw ultra 12.0.	

F. Y. B. Sc
Semester-I
CHE-SEC-112: Preparations and Standardization of Solutions

Total Hours: 30 **Credits: 1**

Course objectives	• To understand the calibration of volumetric apparatus. • To understand the concept Normality and Molarity. • To know about primary standard and secondary standard. • To study calculations related to concentration of solutions.	
Course outcomes	After successful completion of this course, students are expected to • utilize calibrated apparatus for solution preparations. • prepare solutions of different concentrations accords to normality and molarity. • utilized the knowledge of solution preparations. • calculate problems related to concentrations.	
Sr. No.	**Contents**	**Hours**
1	To calibrate volumetric apparatus (Pipette/Burett /Volumetric flask).	**2 Hours for each practical**
2	To prepare 0.1N Hydrochloric acid and standardize it with 0.1N sodium carbonate.	
3	To prepare 0.1N sodium hydroxide and standardize it with 0.1N oxalic acid.	
4	To prepare and standardize 0.1 N Sulphuric acid using standard sodium hydroxide as secondary standard.	
5	Determination of the strength of given unknown oxalic acid solution by titrating it against Potassium permanganate.	
6	To prepare and standardize 0.1 N sodium thiosulphate solution using potassium dichromate as primary standard (Iodometry).	
7	To prepare and standardize 0.1 N iodine solution using standard 0.1 N sodium thiosulphate as secondary standard (Iodimetry)	
8	To prepare and standardize 0.1 N EDTA using granulated zinc as primary standard	
9	Preparation of normal and molar solutions of oxalic acid and volumetric analysis of its acid strength	
10	To determine the percentage purity of given sample of ammonium chloride using standard 0.1 N NaOH	
Study Resources	• Mendham, J. (2009). Vogel's Quantitative Chemical Analysis, 6th edition, 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 edition Textbookof Prentice-Hall. • Mann, F.G., Saunders, B.C., (1960). Practical Organic Chemistry, 4th edition, New Delhi Orient Longman. • Madan, R. L. (2023). Chemistry for B. Sc. Students, Analytical and Organic Chemistry-I, 1st edition, S. Chand and Company Limited, New Delhi.	

Semester-II

F. Y. B. Sc
Semester-II
CHE-DSC-121: Fundamentals 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 solutions. • To learn the concepts of acids and bases. • To study and understand the concepts of electrical conductance and thermodynamics.	
Course outcomes	After successful completion of this course, students are expected to • learn the preparation of solutions and the different ways of expressing concentrations of solutions. • understand the concepts of acids and bases as well as the buffer action. • learn core study of electrical conductance. • understand the fundamental and advance concepts of thermodynamics.	
Unit	**Contents**	**Hours**
Unit I	**Solutions** True solution, Solute, Solvent, Binary solution, Ternary solution, Different types of solutions: Gaseous, Liquid and Solid solutions, Dilute solution, Concentrated solution, Aqueous solution, Non-aqueous solution, Concentrations of Solutions: Percentage by mass (w/w), Percentage by volume (v/v), Molarity (M), Normality (N), Molality (m), Mole fraction (x), Parts per million (ppm), Parts per billion (ppb), and related numericals.	**8**
Unit II	**Acids and Bases** Concepts of acids and bases: Arrhenius theory, Bronsted-Lowry theory and Lewis theory, relative strength of acids and bases, pH of solutions, Measurement of pH, pH scale, Buffer solution, Calculation of pH of buffer solution, and related numerials.	**8**
Unit III	**Electrical Conductance** Ohm's law, Specific resistance, Conductivity (Conductance), Specific conductivity, Equivalent conductivity, Molar conductivity, Dependence of conductivity on concentration, Dependence of equivalent conductivity on concentration, Conductivity cells and Cell Constant, Measurement of conductance: Wheatstone conductivity bridge, and related numericals.	**8**
Unit IV	**Thermodynamics – Basic Concepts** Definition of thermodynamics, Scope and limitations of thermodynamics, System, Surroundings, Boundary, Types of thermodynamic systems: Open, Closed and Isolated system, Intensive and Extensive properties, Thermodynamic processes: Isothermal, Isobaric, Isochoric and Adiabatic processes.	**6**
Study Resources	• 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.	

F. Y. B. Sc
Semester-II
CHE-DSC-122: Chemistry of Functional Groups

Total Hours: 30 **Credits: 2**

Course objectives	• To learn fundamentals of functional groups of organic chemistry. • To study type and structures of functional groups. • To understand the preparation methods of various functional groups. • To acquire the knowledge of transformation of various functional groups.	
Course outcomes	After successful completion of this course, students are expected to • learn drawing structure of functional group. • understand preparation and reaction of OH containing compounds. • understand preparation and reaction of carbonyl compounds. • understand preparation and reaction of N-containing compounds.	
Unit	**Contents**	**Hours**
Unit I	**Introduction to Functional Groups** Hybridization in covalent bonds (sp3, sp2, and sp). Fission-Homolysis and Heterolysis, Structure and stability of reactive intermediates (Carbocation, carbanion, free radical and carbene). Defination of Functional group, and oxidation and reduction. Structure of Functional Groups : Hydrocarbons: Alkane, alkene, alkyne and arene. Haloalkane. O-Containing Functional Groups: Alcohol, phenol, ether, aldehydes, ketone, carboxylic acid, ester, acid anhydride, acid halide and epoxide. N-Containing Functional Groups: Amines, nitro, amide, nitriles, imines, oxime, nitrate, nitrite, nitroso, imide, azide and azo compound. S-Containing Functional Groups: Thiol, sulfide, disulfide, sulfoxide, sulfone, sulfinic acid, sulfonic acid, sulfonate ester, and thioketone (with one example each).	**6**
Unit II	**Oxygen containing Functional Groups** a) Alcohols: Preparation: Preparation of 1^o, 2^o and 3^o alcohols using Grignard reagent, Ester hydrolysis. Reactions: With sodium, esterification, and oxidation (with PCC, and alk. $KMnO_4$). b) Phenols: (Phenol case) Preparation: Cumenehydroperoxide method, from diazonium salts. Reactions: Nitration, halogenation, and sulphonation. c) Ethers (aliphatic and aromatic): Preparation: Williamson ether synthesis Reactions: Cleavage of ethers with HI.	**8**
Unit III	**Carbonyl Containing Functional Group** Aldehydes and Ketones: Preparation: from acid chlorides and from nitriles. Reactions – Reaction with HCN, ROH, and NH_2-G derivatives. Iodoform test. Clemmensen reduction and Wolff Kishner reduction. Carboxylic acids:	**8**

	Preparation: Alkylbenzenes oxidation using $KMNO_4$, and Hydrolysis of nitriles, amides, acyl halide and ester. Reactions: Reactions with metals and alkalies, Esterification and Reactions with PCl_5, PCl_3 and $SOCl_2$.	
Unit IV	**Nitrogen containing Functional Groups** Amines: Preparation: Reduction of nitro compounds (using H_2/Pd and Sn-HCl), Ammonolysis of alkyl halides and reduction of nitriles. Reactions: Basic nature of amines, alkylation with alkyl halide and reaction with nitrous acid (including preparation of diazonium salts). Nitro: Preparation: Preparation of nitroalkanes using HNO_3, Nitration (Preparation of nitroarenes) and Oxidation of primary amines. Reactions: Reduction of nitro compounds and hydrolysis of nitroalkanes (cleavage of nitroalkanes) using mineral acid. Amide: Preparation: From acid chloride with ammonia, and reaction of a carboxylic acid and an amine. Reactions: Hydrolysis of amides to carboxylic Acids and dehydration of amides to nitriles.	**6**
Study Resources	• Clayden, J., Greeves, N., and Warren, S. (2012). Organic chemistry. Oxford University Press, USA. • Smith, M. B. (2020). March's advanced organic chemistry: reactions, mechanisms, and structure. John Wiley and Sons. • Chauhan, M. S (2019). Solomons, Fryhle, Snyder, Organic Chemistry for JEE (Mains and Advanced). John Wiley and Sons. • Madan, R. L. (2022). Chemistry for Degree Students B. Sc. First Year (LPSPE). S. Chand Publishing. • Morrison, R., and Morrison, B. (1983). Boyd organic chemistry. Boston: Allen and Bacon.	

F. Y. B. Sc
Semester-II
CHE-DSC-123: Practicals in Physical and Organic Chemistry

Total Hours: 60 **Credits: 2**

Learning Objectives	• To understand the preparation of different buffer solutions. • To study the conductometric analysis.. • To understands the different purification techniques. • To study the identification of different functional groups in organic compounds.	
Course Outcomes	After successful completion of this course, students are expected to • understand different combinations and phof buffer solutions. • understand preparation of organic compounds by green method. • apply concept of purification for synthesized products. • detect different functional groups in organic compounds.	
Sr. No.	**Contents (Any 15)**	**Hours**
1	To study the given properties (Odour, Solubility in water, litmus paper test, reaction with sodium bicarbonate) of ethanoic acid.	**4**
2	To identify the presence of unsaturation in the given organic compound. (Two Compounds)	**4**
3	Determination of equivalent weight of Mg by eudiometer.	**4**
4	Preparation of buffer solutions of sodium acetate-acetic acid and measurement of its pH	**4**
5	Preparation of buffer solutions of ammonium chloride-ammonium hydroxide and measurement of its pH	**4**
6	Determination of pH of soaps and shampoos.	**4**
7	Determination of cell constant conductometrically.	**4**
8	Determination of specific conductances of given solution conductometrically.	**4**
9	Determination of heat capacity of calorimeter for different volumes.	**4**
10	Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.	**4**
11	Determination of enthalpy of ionization of acetic acid.	**4**
12	Demostration of various system/processes (Systems: Open, closed and isolated, Processes: Isothermal, isochoric, isobaric and adiabatic).	**4**
13	To test presence of alcoholic group in the given organic compound. (Sodium metal test/Xanthate test/ Ester test/ Ceric ammonium Nitrate test) (Two compound)	**4**
14	To test presences of phenolic group in the given organic compound. (Litmus test/ $FeCl_3$ test/ Azo dye test/ Phthalein test/ Libermann's test) (Two compound)	**4**
15	To test presences of aldehydic group in the given organic compound. (2, 4-DNP test/$NaHSO_3$ test/ Iodoform/ Tollen's reagent/Fehling's solution/Schiff's Reagent) (Two compound)	**4**
16	To test presences of ketonic group in the given organic compound. (2, 4-DNP test/$NaHSO_3$ test/ Iodoform/ Tollen'sreagent/Fehling's solution/Schiff's Reagent) (Two compound)	**4**

17	To test presences of carboxylic group in the given organic compound. (Litmus test/ $NaHSO_3$ test/Ester formation test) (Two compound)	**4**
18	Purification of organic compound by sublimation.	**4**
19	Purification and separation of organic mixture by distillation.	**4**
20	Detection of extra elements (N, S, Cl, Br, I) by Lassainge'stest from organic compounds (containing upto two extra elements).	**4**
Study Resources	• Khosla, B. D., Garg, V. C. and Gulati, A. (2011). Senior Practical Physical Chemistry, R. Chand & Co. New Delhi. • Mendham, J., (2009). Vogel's Quantitative Chemical Analysis, 6th edition, 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 edition Textbookof Prentice-Hall. • Mann, F. G., Saunders, B. C., (1960). Practical Organic Chemistry, 4th edition, New Delhi Orient Longman. • Madan R. L. (2023). Chemistry for B. Sc. Students, Analytical and Organic Chemistry-I, 1st edition, S. Chand and Company Limited, New Delhi.	

F. Y. B. Sc
Semester-II
CHE-MIN-121: Introduction to Carbon Compounds

Total Hours: 30 **Credits: 2**

Course objectives	• To study fundamentals of organic chemistry. • To learn fundamentals of functional groups of organic chemistry. • To study type and structures of functional groups. • To learn the IUPAC nomenclature.	
Course outcomes	After successful completion of this course, students are expected to • understand the fundamentals concepts of organic chemistry. • understand an electronic and structural effect in organic molecules. • learn the systematic structure drawing of various functional groups. • apply the concept of IUPAC nomenclature to give systematic name to the compounds.	
Unit	**Contents**	**Hours**
Unit I	**Fundamentals of Organic Chemistry-I** Introduction**, e**lectronegativity, organic chemistry and periodic table Chemical Bonding: Chemical bond, covalent and ionic bond, bonding in organic molecules. Drawing of molecules (Types of structure): Complete structural formula, condensed structural formula, bond line structural formula and Wedge-Dash formula. Electronic Effects: Inductive effect, Resonance, Hyperconjugation and Tautomerism. Terms related to organic reactions: Substrate, reagent, catalyst, nucleophile and electrophile. Applications of Organic Chemistry.	**8**
Unit II	**Fundamentals of Organic Chemistry-II** Hybridization in covalent bonds (sp3, sp2, and sp). Fission-Homolysis and Heterolysis, Structure and stability of reactive intermediates (Carbocation, carbanion, free radical and carbine). Definition of Functional group, oxidation and reduction, oxidizing agent, and reducing agents. Types of reactions (Definition with an illustrative example): Addition, elimination, substitution and rearrangement. Acids and Bases in Organic molecules: Acid and base, pKa, and factors affecting acid-base strengths.	**7**
Unit III	**Introduction to Functional Groups** Drawing Structure of Functional Groups: Hydrocarbons: Alkane, alkene, alkyne and arene. Haloalkane. O-Containing Functional Groups: Alcohol, phenol, ether, aldehydes, ketone, carboxylic acid, ester, acid anhydride, acid halide and epoxide. N-Containing Functional Groups: Amines, nitro, amide, nitriles, imines, oxime, nitrate, nitrite, nitroso, imide, azide and azo compound. S-Containing Functional Groups: Thiol, sulfide, disulfide, sulfoxide, sulfone, sulfinic acid, sulfonic acid, sulfonate ester, and thioketone.	**8**
Unit IV	**IUPAC Nomenclature** Rules for IUPAC nomenclature of Hydrocarbons: Saturated hydrocarbons (alkanes), and unsaturated hydrocarbons (alkenes and alkynes). Organic compounds containing one functional group: Alcohols, ether, aldehydes, ketone, carboxylic acid, ester, amines, amide, and nitrile. Organic compounds containing functional group and multiple bonds. Organic compounds containing two or more than two functional groups. Cyclic compounds: Bicyclic and Spiro compounds. Aromatic compounds.	**7**

Study Resources	• Clayden, J., Greeves, N., and Warren, S. (2012). Organic chemistry. Oxford University Press, USA. • Smith, M. B. (2020). March's advanced organic chemistry: reactions, mechanisms, and structure. John Wiley & Sons. • Chauhan, M. S (2019). Solomons, Fryhle, Snyder, Organic Chemistry for JEE (Mains and Advanced). John Wiley & Sons. • Madan, R. L. (2022). Chemistry for Degree Students B. Sc. First Year (LPSPE). S. Chand Publishing. • Morrison, R., and Morrison, B. (1983). Boyd organic chemistry. Boston: Allen and Bacon.	

F. Y. B. Sc
Semester-II
CHE-MIN-122: Basic Practicals in Chemistry

Total Hours: 60 **Credits: 2**

Course objectives	• To understand the preparation of different buffer solutions. • To study conductometric analysis. • To understands the different purification techniques. • To study the identification of different functional groups in organic compounds.	
Course outcomes	After successful completion of this course, students are expected to: • understand different combinations and phof buffer solutions. • understand meaurment of conductance of solutions. • apply concept of purification for synthesized products. • detect different functional groups in organic compounds.	
Sr. No.	**Contents (Any 15)**	**Hours**
1	To study the given properties (Odour, Solubility in water, litmus paper test, reaction with sodium bicarbonate) of ethanoic acid.	**4**
2	To identify the presence of unsaturation in the given organic compound. (Two Compounds)	**4**
3	Determination of equivalent weight of Mg by eudiometer.	**4**
4	Preparation of buffer solutions of sodium acetate-acetic acid and measurement of its pH	**4**
5	Preparation of buffer solutions of ammonium chloride-ammonium hydroxide and measurement of its pH	**4**
6	Determination of pH of soaps and shampoos.	**4**
7	Determination of cell constant conductometrically.	**4**
8	Determination of specific conductances of given solution conductometrically.	**4**
9	Determination of heat capacity of calorimeter for different volumes.	**4**
10	Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.	**4**
11	Determination of enthalpy of ionization of acetic acid.	**4**
12	Demostration of various system/processes (Systems: Open, closed and isolated, Processes: Isothermal, isochoric, isobaric and adiabatic).	**4**
13	To test presence of alcoholic group in the given organic compound. (Sodium metal test/Xanthate test/ Ester test/ Ceric ammonium Nitrate test) (Two compound)	**4**
14	To test presences of phenolic group in the given organic compound. (Litmus test/ $FeCl_3$ test/ Azo dye test/ Phthalein test/ Libermann's test) (Two compound)	**4**
15	To test presences of aldehydic group in the given organic compound. (2, 4-DNP test/$NaHSO_3$ test/ Iodoform/ Tollen's reagent/Fehling's solution/Schiff's Reagent) (Two compound)	**4**
16	To test presences of ketonic group in the given organic compound. (2, 4-DNP test/$NaHSO_3$ test/ Iodoform/ Tollen'sreagent/Fehling's solution/Schiff's Reagent) (Two compound)	**4**

17	To test presences of carboxylic group in the given organic compound. (Litmus test/ $NaHSO_3$ test/Ester formation test) (Two compound)	**4**
18	Purification of organic compound by sublimation.	**4**
19	Purification and separation of organic mixture by distillation.	**4**
20	Detection of extra elements (N, S, Cl, Br, I) by Lassainge'stest from organic compounds (containing upto two extra elements).	**4**
Study Resources	• Khosla, B. D., Garg, V. C. and Gulati, A. (2011). Senior Practical Physical Chemistry, R. Chand & Co. New Delhi. • Mendham, J. (2009). Vogel's Quantitative Chemical Analysis, 6th edition, 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 edition Textbookof Prentice-Hall. • Mann, F. G., Saunders, B. C., (1960). Practical Organic Chemistry, 4th edition, New Delhi Orient Longman. • Madan R. L. (2023). Chemistry for B. Sc. Students, Analytical and Organic Chemistry-I, 1st edition, S. Chand and Company Limited, New Delhi.	

F. Y. B. Sc
Semester-II
CHE-GE-121: Health and Nutrition

Total Hours: 30 **Credits: 2**

Course objectives	• To understand the dietary contents of the food. • To understand the modes of nutrition in plants. • To study the advances in crop yield. • To get the knowledge of wastewater treatment.	
Course outcomes	After successful completion of this course, students are expected to • understand the nutritional value of food. • learn the synthesis of plant food. • get the knowledge of food resources improvising methods. • understand the wastewater treatment.	
Unit	**Contents**	**Hours**
Unit I	**Components of Food** Nutrients, test for starch, fats and protein, food nutrients, body building foods. Vitamins: classification and nomenclature. sources, deficiency and diseases of vitamin A1, vitamin B1, vitamin C, vitamin D, vitamin E, & vitamin K1. and Balanced diet.	**6**
Unit II	**Nutrition in Plants** Mode of nutrition in plants, photosynthesis, synthesis of plant food other than carbohydrates, other modes of nutrition in plants, saprotrophs, replenishment of nutrients in soil, transportation of substances in plants, water and minerals, and transpiration.	**8**
Unit III	**Improvement in Food Resources** Improvement in crop yields, crop variety, crop production, nutrient management, manure, fertilizers, irrigation, cropping patterns, crop protection management, and storage of grains.	**8**
Unit IV	**Wastewater Treatment** Water-Introduction, cleaning of water, sewage, treatment of polluted water, wastewater treatment plant (WWTP), better housekeeping practices, sanitation and disease, alternative arrangement for sewage disposal, and sanitation at public places**.**	**8**
Study Resources	• Mudambi S. R., Rajagopal M. V., (2020). Fundamentals of Foods, Nutrition and Diet Therapy, 6th editionNew age International. • Srilakshmi, B., (2021) Nutrition Science, 7thedition .New Age International publishers. • Rathore, N. S., Mathur, G. K., Chasta, S. S., (2012). Post Harvest Management and Processing of Fruits and Vegetables, Indian council of Agricultural Researcher, New Delhi. • Prasad R., (2013). Crop Nutrition-Principle and Practices, 2nd edition, New Vishal publications. • Shrivastava A., (2018). Waste water treatment and water management, Notion Press media Pvt. Ltd.	

F. Y. B. Sc
Semester-II
CHE-SEC-121: Basic Analytical Chemistry

Total Hours: 30 **Credits: 2**

Course objectives	• To get the knowledge of basic analytical chemistry. • To understand an errors and evaluation methods in analytical chemistry. • To learn basics in chromatographic techniques. • To get the knowledge of analysis of water sample and food products**.**	
Course outcomes	After successful completion of this course, students are expected to • get the knowledge of basic analytical chemistry. • understand errors and evaluation methods in analytical chemistry. • get the basic knowledge in chromatographic techniques. • familiar with analysis of water sample and food products	
Unit	**Contents**	**Hours**
Unit I	**Introduction to Analytical Chemistry** Introduction, types of analysis, Classification of analytical methods, selection of analytical methods, factor affecting on the choice of analytical methods, laboratory notebook, and safety in analytical laboratory.	**6**
Unit II	**Errors and Evaluation** Central Value, mean, median, precision, accuracy, errors, sources and types of error, Minimization of errors, rounding off, and reporting of analytical data.	**8**
Unit III	**Chromatography** Introduction, common terminologies used in chromatography, general principle of chromatographic separations, distribution constant, types of chromatography: paper chromatography and thin layer chromatography, and Rf value application of chromatography.	**8**
Unit IV	**Analysis of Water Sample and Food Products** A] Analysis of water sample Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods. Determination of pH, acidity and alkalinity of a water sample. B] Analysis of Food Products Nutritional value of foods, idea about food processing, food preservations and adulteration. Identification of adulterants in some common food items like salt, coffeepowder, chilli powder, turmeric powder and pulses, etc.	**8**
Study Resources	• Christian, G. D. (2004). Analytical Chemistry John Wiley and Sons. • Gupta,A. L., (2013). Analytical chemistry, 5th edition, Pragati publication. • Skoog, D., West, D., & Holler, F. (1992). Fundamentals of analytical chemistry Saunders College Pub. Fort Worth. • Dean, J. A., (1992). Analytical Chemistry Notebook, McGraw Hill. • Vogel, A. I., (1996), Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall.	

F. Y. B. Sc
Semester-II
CHE-SEC-122: Practicals of Food Adulteration

Total Hours: 30 **Credits: 1**

Learning Objectives	• To study common food adulterants in food stuffs. • To study identification process of food adulterants.	
Course outcomes	After successful completion of this course, students are expected to • apply knowledge of detection of adulterantsto daily life. • create awareness about food adulteration in society.	
Sr. No.	**Contents**	**Hours**
1	To detect the presence of adulterants in milk and sweet curd.	**2 Hours for each practical**
2	To detect the presence of adulterants in sugar and honey.	
3	To detect the presence of adulterants in samples of chilli powder and mustard oil	
4	To detect the presences of adulterants in turmeric powder and powder spices.	
5	To detect the presences of adulterants in asafoetida (hing) and pepper	
6	To detect the presences of adulterants in tea powder and besan.	
7	To detect the presences of adulterants in jaggery and parched rice	
8	To detect the presence of adulterants in fat, oil and butter.	
9	To detect the presence of adulterants in Ice cream and bevarages.	
10	To detect the presence of adulterants in salt and pulses.	
Study Resources	• DART, Detect Adultaration with Rapid Test, Food Safety and Standred Authority of India. • Quik test for some adultarent in food, (2012) Foods Safety and Standared authority of India (FSSAI), New Delhi.	