



Date :- 01/08/2024

NOTIFICATION

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

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

The Syllabi of B. Sc. in Chemistry (First and Second Semesters) as per **NATIONAL EDUCATION POLICY – 2020 (2024 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

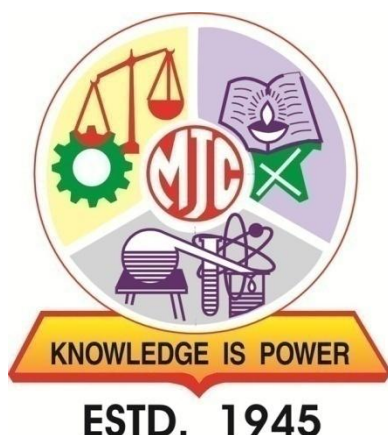
To :

- 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.

Knowledge is Power

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. Honors/Honors with Research
(F.Y.B.Sc. Chemistry)

Under Choice Based Credit System (CBCS)
and
as per NEP-2020 Guidelines

[w.e.f. Academic Year: 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 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. 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.

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 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.
2	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.
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.

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/ Honours with Research Degree Programme with Multiple Entry and Exit

F.Y. B.Sc.

Year (Level)	Sem	Subject-I (M-1)	Subject-II (M-2)	Subject-III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT, RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
I (4.5)	I	DSC-1(2T) DSC-2(2P)	DSC-1(2T) DSC-2(2P)	DSC-1(2T) DSC-2(2P)	OE-1(2T)	---	AEC-1(2T) (Eng) VEC-1(2T) (ES) IKS(2T)	CC-1(2T)	22	UG Certificate
	II	DSC-3(2T) DSC-4(2P)	DSC-3(2T) DSC-4(2P)	DSC-3(2T) DSC-4(2P)	OE-2(2T) OE-3(2P)	---	AEC-2(2T) (Eng) VEC-2(2T) (CI)	CC-2(2T)	22	
	Cum. Cr.	8	8	8	6	---	10	4	44	
Exit option: Award of UG Certificate with 44 credits and an additional 4 credits core NSOF 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-5(2T) DSC-6(2T) DSC-7(2P)	---	MIN-1(2T) MIN-2(2T) MIN-3(2P)	---	OE-4(2T)	SEC-1(2T)	AEC-3(2T) (MIL)	CC-3(2T) CEP(2)	22	UG Diploma
	IV	DSC-8(2T) DSC-9(2T) DSC-10(2P)	---	MIN-4(2T) MIN-5(2P)	---	OE-5(2T)	SEC-2(2T) SEC-2(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-11(2T) DSC-12(2T) DSC-13(2T) DSC-14(2P) DSC-15(2P)	DSE-1A/B (2T) DSE-2A/B (2P)	---	---	---	VSC-1(2T) VSC-2(2P)	---	OJT/Int (4)	22	UG Degree
	VI	DSC-16(2T) DSC-17(2T) DSC-18(2T) DSC-19(2T) DSC-20(2T) IKS DSC-21(2P) DSC-22(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-23(4T) DSC-24(4T) DSC-25(4T) DSC-26(2P)	DSE-5A/B (2T) DSE-6A/B (2P)	RM(4T)	---	---	---	---	22	UG Honours Degree
	VIII	DSC-27(4T) DSC-28(4T) DSC-29(4T) DSC-30(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-23(4T) DSC-24(4T) DSC-26(2P)	DSE-5A/B (2T) DSE-6A/B (2P)	RM(4T)	---	---	---	RP(4)	22	UG Honours with Research Degree
	VIII	DSC-27(4T) DSC-28(4T) DSC-30(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 Language

- 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 F.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 I, Level – 4.5											
DSC-1	DSC	CHE-DSC-111	Inorganic and Organic Chemistry	2	2	---	2	20	---	30	---
DSC-2	DSC	CHE-DSC-112	Practicals on Inorganic and Organic Chemistry	2	---	4	4	---	20	---	30
OE-1	OE	CHE-OE-111	Chemistry in Everyday Life	2	2	---	2	20	---	30	---
Semester II, Level – 4.5											
DSC-3	DSC	CHE-DSC-121	Physical and Organic Chemistry	2	2	---	2	20	---	30	---
DSC-4	DSC	CHE-DSC-122	Practicals in Physical and Organic Chemistry	2	---	4	4	---	20	---	30
OE-2	OE	CHE-OE-121	Health and Nutrition	2	2	---	2	20	---	30	---
OE-3	OE	CHE-OE-122	Practicals of Food Adulteration	2	---	4	4	---	20	---	30

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:

- Individual Assignments
- Seminars/Classroom Presentations/Quizzes
- Group Discussions/Class Discussion/Group Assignments
- Case studies/Case lets
- Participatory & Industry-Integrated Learning/Field visits
- Practical activities/Problem Solving Exercises
- Participation in Seminars/Academic Events/Symposia, etc.
- Mini Projects/Capstone Projects
- Book review/Article review/Article preparation
- Any other academic activity
- 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.

**F.Y.B.Sc.
(Chemistry)
Semester I**

FYBSc Chemistry (Major)
Semester I
CHE-DSC-111: Inorganic and Organic Chemistry

Total Hours: 30

Credits: 2

Course objectives	- To study atomic structure. - To study the general properties of <i>s</i> and <i>p</i> block elements. - To study the fundamentals of organic chemistry. - To study the IUPAC nomenclature of organic compounds.	
Course outcomes	After successful completion of this course, students are expected - To understand the structure of an atom. - To understand the properties of <i>s</i> and <i>p</i> block elements. - To learn the fundamentals of organic chemistry. - To apply the IUPAC nomenclature for naming organic compounds.	
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 Properties of s- and p-block Elements s- block elements General characteristics, electronic configuration, atomic and ionic radii, ionisation energy, electron affinity, electronegativity, and metallic (electropositive) character. p- block elements General characteristics: electronic configuration, atomic and ionic radii, ionisation energy, electron affinity, electronegativity, and non-metallic (electronegative) character.	7
Unit III	Fundamentals of Organic Chemistry Introduction, covalent and ionic bond, 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.	7
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: Alcohol, ether, aldehyde, ketone, carboxylic acid, ester, amine, 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.	8
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., VinodVasishtha 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. • 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.	
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FYBSc Chemistry (Major)
Semester I
CHE-DSC-112: Practicals on Inorganic and Organic Chemistry

Total Hours:60

Credits:2

Course objectives	- To study organic qualitative analysis. - To study inorganic qualitative analysis.	
Course Outcomes	After successful completion of this course, students are expected to - To understand analysis of organic compound qualitatively. - Understand analysis of inorganic compound qualitatively	
Sr. No.	Contents (Any 15)	Hours
	Organic Chemistry experiments Organic Qualitative (Single compound) Analysis (Any Eight Compounds) 1. Type determination. 2. Preliminary tests. 3. Physical constant. 4. Functional group tests.	32
	Inorganic Chemistry experiments Inorganic Qualitative (Single Salt) Analysis (Any seven Compounds). Analysis of inorganic compound containing one cation and one anion (excluding phosphate and borates).	28
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 Textbook of 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.	

FYBSc Chemistry (Open Elective)
Semester I
CHE-OE-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.
(Chemistry)
Semester II**

FYBSc Chemistry (Major)
Semester II
CHE-DSC-121: Physical and Organic Chemistry

Total Hours: 30

Credits: 2

Course objectives	- To orient and acquaint the UG students towards the fundamental concepts of physical chemistry. - To study and understand the concepts of electrical conductance and thermodynamics. - To acquire knowledge about functional groups. - To learn the properties of aromatic compounds.	
Course outcomes	After successful completion of this course, students are expected to - Learn the structure and role of functional groups in chemical organic reactions. - Understand the fundamental and advance concepts of thermodynamics. - Understand the concepts of aromatic compound and aromatic properties. - Learn core study of electrical conductance.	
Unit	Contents	Hours
Unit I	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 II	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.	7
Unit III	Introduction to 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).	10
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).	05
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.	
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FYBSc Chemistry (Major)
Semester II
CHE-DSC-122: Practicals in Physical and Organic Chemistry

Total Hours:60

Credits:2

Course objectives	- To understand the concept of pH. - To study enthalpy of ionization and enthalpy of neutralization of reaction. - To study organic preparations of organic derivatives.	
Course outcomes	After successful completion of this course, students are expected to - Utilize the concept pH. - Utilized the knowledge of enthalpy of ionization and enthalpy of neutralization of reaction. - Learn organic preparations of organic derivatives.	
Sr. No.	Contents	Hours
	Physical Chemistry (Any 7)	
1	Calibration of volumetric apparatus Pipette/ Volumetric flask.	4
2	Conductometric titration NaOH Vs HCl/CH ₃ COOH	4
3	Determination of dissociation constant of weak monobasic (CH ₃ COOH) acid by conductance measurement.	4
4	To prepare buffer solutions of sodium acetate-acetic acid /ammonium chloride- ammonium hydroxide and measurement of its pH.	4
5	Determination of heat capacity of calorimeter (determination of water equivalent of thermos flask).	4
6	To determine enthalpy of neutralization of a hydrochloric acid with sodium hydroxide.	4
7	To determine enthalpy of ionization of acetic acid.	4
8	Determination of heat of solution of KNO ₃ /NH ₄ Cl by water equivalent method.	4
9	Determination of enthalpy of hydration of copper sulphate.	4
10	To study the solubility of benzoic acid in water and determination of ΔH.	4
	Organic Preparations (Any 6)	
11	Preparation of p-nitro acetanilide from acetanilide.	4
12	Preparation of m-nitroaniline from m-dinitrobenzene.	4
13	Synthesis of dibenzalpropanone from benzaldehyde and acetone using NaOH.	4
14	Preparation of 2,4,6-tribromoaniline from aniline.	4
15	Preparation of p-bromo acetanilide from acetanilide	4
16	Preparation of p-nitro salicylic acid from salicylic acid by green approach.	4
17	Preparation of p- nitro benzyl alcohol from p-nitrobenzaldehyde.	4
18	Preparation of acetaldehyde from ethanol.	4
	Derivatives (Any 2)	
19	To prepare semicarbazone derivative of aldehyde/ ketone.	4
20	To prepare 2:4 dinitrophenylhydrazone derivative of aldehyde/ ketone	4
21	To prepare acetyl derivative of aniline by using Zn dust/acetic acid.	4
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 Textbook of 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.	
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FYBSc Chemistry (Open Elective)
Semester II
CHE-OE-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 edition New age International. - Srilakshmi, B., (2021) Nutrition Science, 7th edition .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.	

FYBSc Chemistry (Open Elective)
Semester II
CHE-OE-122: Practicals of Food Adulteration

Total Hours: 60

Credits: 2

Course 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 adulterants to daily life. - create awareness about food adulteration in society.	
Sr. No.	Contents (Any 15)	Hours
1	To detect the presence of adulterants in milk and sweet curd.	4
2	To detect the presence of adulterants in sugar and honey.	4
3	To detect the presence of adulterants in samples of chilli powder and mustard oil	4
4	To detect the presences of adulterants in turmeric powder and powder spices.	4
5	To detect the presences of adulterants in asafoetida (hing) and pepper	4
6	To detect the presences of adulterants in tea powder and besan.	4
7	To detect the presences of adulterants in jaggery and parched rice	4
8	To detect the presence of adulterants in fat, oil and butter.	4
9	To detect the presence of adulterants in Ice cream and bevarages.	4
10	To detect the presence of adulterants in salt and pulses.	4
11	To detect the presence of synthetic colors in sweet curd.	4
12	To detect the presence of artificial sweetener in parched rice.	4
13	To detect the presence of alum in drinking water.	4
14	To detect the presence of coal tar dye in sweets.	4
15	To detect the presence of artificial colors in fruit juices.	4
16	To detect the presence of lead salts in green vegetables.	4
17	To detect the presence of mud or soapstone in wheat flour.	4
18	To detect the presence of starch in paneer.	4
19	To detect the presence of iron filings in supari (betel nut).	4
20	To detect the presence of wax coating on apples.	4
Study Resources	- Manual on Food Adulteration Detection FSSAI - Laboratory Manual of Food Adulteration and Quality Control S. Sivasankar "Comprehensive Food Science and Nutrition" Sunit S. Dhawan "Food Chemistry" H.D. Belitz and W. Grosch	

	• "Indian Pharmacopoeia" • "Manual of Methods of Analysis of Foods" FSSAI • DART, Detect Adulteration with Rapid Test, Food Safety and Standard Authority of India. • Quik test for some adulterant in food, (2012) Food Safety and Standard authority of India (FSSAI), New Delhi.	
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