CENTRAL UNIVERSITY OF HARYANA

(Established under the Central Universities Act, 2009) (NAAC Accredited 'A' Grade)



Curriculum and Syllabi

Of

Integrated B.Sc.-M.Sc. (Chemistry) (w.e.f. Session 2022-23)

DEPARTMENT OF CHEMISTRY SCHOOL OF BASIC SCIENCES

Approved by:Approval Status :Approval Date

BOS √ 06-09-2022 School Board √ 12-09-2022 Academic Council √ 07-10-2022

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VISION AND MISSION

i) Vision and Mission of the University

Vision

To develop enlightened citizenship of a knowledge society for peace and prosperity of individuals, nation and the world, through promotion of innovation, creative endeavours, and scholarly inquiry.

Mission

To serve as a beacon of change, through multi-disciplinary learning, for creation of knowledge community, by building a strong character and nurturing a value-based transparent work ethics, promoting creative and critical thinking for holistic development and self-sustenance for the people of India. The University seeks to achieve this objective by cultivating an environment of excellence in teaching, research and innovation in pure and applied areas of learning.

ii) Vision and Mission of the Department

Vision

To establish a world-class teaching and research reputation of the department that contributes to society through its innovative, creative and scholarly approach.

Mission

To educate the students by adopting highest academic and professional standards to meet the global competency in the field of chemical sciences. To establish and maintain a high quality of support, research facilities, multidisciplinary and skill-based learning opportunities to our staff, students and researchers to orient them to world class creative and innovative minds.

1. BACKGROUND

i) NEP-2020 and LOCF an integrated Approach

Considering the curricular reforms as instrumental for desired learning outcomes, all the academic departments of Central University of Haryana made a rigorous attempt to revise the curriculum of undergraduate and postgraduate programmes in alignment with National Education Policy-2020 and UGC Quality Mandate for Higher Education Institutions-2021. The process of revising the curriculum could be prompted with the adoption of "Comprehensive Roadmap for Implementation of NEP-2020" in the 32nd meeting of the Academic Council of the University held on April 23, 2021. The Roadmap identified the key features of the Policy and elucidated the Action Plan with well-defined responsibilities and indicative timeline for major academic reforms.

The process of revamping the curriculum started with the series of webinars and discussions conducted by the University to orient the teachers about the key features of the Policy, enabling them to revise the curriculum in sync with the Policy. Proper orientation of the faculty about the vision and provisions of NEP-2020 made it easier for them to appreciate and incorporate the vital aspects of the Policy in the revised curriculum focused on 'creating holistic, thoughtful, creative and well-rounded individuals equipped with the key 21st century skills' for the 'development of an enlightened, socially conscious, knowledgeable, and skilled nation'.

With NEP-2020 in background, the revised curricula articulate the spirit of the policy by emphasising upon—integrated approach to learning; innovative pedagogies and assessment strategies; multidisciplinary and cross-disciplinary education; creative and critical thinking; ethical and Constitutional values through value-based courses; 21st century capabilities across the range of disciplines through life skills, entrepreneurial and professional skills; community and constructive public engagement; social, moral and environmental awareness; Organic Living and Global Citizenship Education (GCED); holistic, inquiry-based, discovery-based, discussion-based, and analysis-based learning; exposure to Indian knowledge system, cultural traditions and classical literature through relevant courses offering 'Knowledge of India'; fine blend of modern pedagogies with indigenous and traditional ways of learning; flexibility in course choices; student-centric participatory learning; imaginative and flexible curricular structures to enable creative combination of disciplines for study; offering multiple entry and exit points initially in undergraduate programmes; alignment of Vocational courses with the International Standard Classification of Occupations maintained by the International Labour Organization; breaking the silos of disciplines; integration of extra-curricular and curricular aspects; exploring internships with local industry, businesses, artists and crafts persons; closer collaborations between industry and higher education institutions for technical, vocational and science programmes; and formative assessment tools to be aligned with the learning outcomes, capabilities, and dispositions as specified for each course. In case of UG programmes in Engineering and Vocational Studies, it was decided that the departments shall incorporate pertinent NEP recommendations while complying with AICTE, NBA, NSQF, International Standard Classification of Occupations, Sector Skill Council and other relevant agencies/sources. The University has also developed consensus on adoption of Blended Learning with 40% component of online teaching and 60% face to face classes for each programme.

The revised curricula of various programmes could be devised with concerted efforts of the faculty, Heads of the Departments and Deans of Schools of Study. The draft prepared by each department was discussed in series of discussion sessions conducted at Department, School and the University level. The leadership of the University has been a driving force behind the entire exercise of developing the uniform template and structure for the revised curriculum. The Vice Chancellor of the University conducted series of meetings with Heads and Deans to deliberate upon the vital parameters of the revised curriculum to formulate a uniform template featuring Background, Programme Outcomes, Programme Specific Outcomes, Postgraduate Attributes, Structure of Masters Course, Learning Outcome Index, Semester-wise Courses and Credit Distribution, Course-level Learning Outcomes, References and Appendices. The experts of various Boards of Studies and School Boards contributed to a large extent in giving the final shape to the revised curriculum of each programme.

To ensure the implementation of curricular reforms envisioned in NEP-2020, the University has decided to implement various provisions in a phased manner. Accordingly, the curriculum may be reviewed annually.

ii) About Chemistry

Chemistry is the science of matter and its transformations. It addresses fundamental questions about the observable matter, ranging from its components, structure, properties and interconversions. As a system of knowledge, Chemistry not only explains the existence and behavior of matter around and within us, but also empowers us to manipulate the matter into new and improved forms for our use. From the ancient practices of rasayan vidya and alchemy, modern chemistry has grown over centuries into a formidable science that touches all aspects of human life. Humanity's progress in the last three centuries is pivoted on the contributions of chemistry, chemical industry and associated endeavors. The range of influence of chemistry in our life spans from essentials such as food (agrochemicals, preservatives), shelter (cement, metals, alloys, polymers) and health (drugs, cosmetics, soap, toothpaste), to advancements such as textiles (polymers, leather), beverages (flavoring and fermentation), crime fighting (forensics), weaponry (explosives), space travel (fuel) and cosmology (element detection). The list can go on endlessly. The most visible contribution of chemistry to civilization is achieved by the advancements in modern medicine that was fuelled by organic chemistry. This led to significant improvements in the living standards, extension of human average life span and fighting of dangerous diseases such as cancer and microbial infections.

Chemistry is placed centrally between the other two major branches of science, namely physics and biology. Therefore, it is often called the *central science*. It influences the developments in these two broad realms of science as much as it is influenced by the discoveries in them. The fundamental importance of chemistry and chemical industry in sustaining human civilization demands for a steady supply of trained and skilled manpower. Thus, it is unsurprising that it is an essential and integral department in higher education institutions.

Education in chemistry not only imparts the technical know-how about structure, reactions and properties of matter, but also empowers the learner to raise fundamental

questions about various natural phenomena, address local issues and come up with sustainable solutions, identify areas of life where intervention of chemistry can bring about progress and imbibe and spread the spirit of free enquiry and scientific temper.

iii) About the Programme (Nature, Extent and Aims)

The integrated B.Sc.-M.Sc. Programme in Chemistry will impart advanced knowledge of basic and applied chemical sciences to the graduates. It will prepare the students for taking up challenging assignments in academia and industry and also empower them with skill and knowledge for generating employment for their own and others. The Programme introduces the students to advanced developments in chemical sciences as well as in the field of other allied sciences, by providing them multidisciplinary and interdisciplinary courses. The design of choice-based curriculum can enrich students with analytical and problem-solving capabilities. It is designed to bring out the best of the abilities of each student, allow them to sharpen the scientific temper and be abreast with the contemporary developments in the area.

The programme includes a balanced combination of *Core, Elective* and *Ability Enhancement* Courses. The courses are designed in such a way to cover the entire spectrum of chemical sciences from fundamentals (that will bring admitted students from various backgrounds to a common level) to most recent advancements in the field (that will make them ready to take up challenging assignments in the real world).

The integrated B.Sc.-M.Sc. Programme in Chemistry is of a five-year duration which is divided into ten semesters. The teaching and learning in the Programme will involve theory (lectures), practicals, tutorial and seminar-based classes. During the whole programme about 40 % syllabus of each course may be delivered via online mode and with a blended teaching-learning approach.

The curriculum will be taught through formal lectures with the aid of pre-made presentations, audio and video tools whenever necessary. Other teaching aids can also be used as and when required. The additional requirements like industrial visits, summer training and project work are also incorporated into the curriculum.

The Aims of the programme include

- To inculcate basic to advanced knowledge of chemical sciences among students.
- To provide higher education, disciplinary and inter/multi-disciplinary researchoriented knowledge to the students to make them lifelong learners.
- To provide a learned, skilled and creative pool of graduates who are ready to take up challenging assignments in different kinds of chemical industries, research institutions and academia.
- To mould responsible, proactive citizens who are equipped with scientific thinking and skills to address problems of their locality
- Adequate blend of theory, computation and hands-on experiments.
- Modernized lab courses close to recent/current research.

iv) Qualification Descriptors (possible career pathways)

On successful completion of the Integrated B.Sc.-M.Sc. Chemistry Programme, students of the department are expected to be ready to take up opportunities all around the world in areas that demand skills in chemical and allied sciences. As the chemical industry is enormously vast and diverse, numerous opportunities and challenges await the graduates. The graduates are expected to satisfactorily address the professional expectations, maintain a work-life balance and lead productive and meaningful lives. Some of the possible career paths for the undergraduate and postgraduate students may be:

- 1. Teaching and Research in academia
- 2. Research scientists in pharmaceutical and other chemical and material industries
- 3. Research scientists in other allied sciences
- 4. Entrepreneurship in chemical science-based ventures

5. Administrative Assignments in various government and private agencies

6. Chemist/Scientist/Technician assignments in any of the following industries: pharmaceutical, polymers, petrochemicals, materials sciences, nanotechnology, fuels, non-conventional energy, renewable resources, agrochemicals, fermentation and processing, paints and pigments, metallurgy, packaging, cosmetics, cements, natural products, forensics, explosives, and any other various allied branches of chemistry.

2. STRUCTURE OF INTEGRATED B.Sc.-M.Sc. PROGRAMME

The Integrated B.Sc.-M.Sc. Chemistry Programme is of a *five-year* duration which is divided into ten semesters. The programme under Choice-Based Credit System (CBCS) includes a balanced combination of *Core, Elective* and *Ability Enhancement Courses* (Compulsory and Skill based). Distribution of the courses for undergraduate programme (for first three years) is given in **Table-1**.

The programme offers exit options to the students as per the relevant ordinances of CUH and guidelines of UGC and Ministry of Education.

After successful completion of five years (ten semesters) of the programme the candidate will be awarded with the Integrated Degree i.e. **Integrated B.Sc.-M.Sc. (Chemistry)**.

Sr. No.	Types of Courses	Nature	Total Credit	Credit % age of Courses	% age of Courses
1	Core Courses (CC)	Compulsory Courses (CC)	84	56.75	53.85
2	Elective Courses (EC)	Discipline Specific Elective Courses (DSE)	24	16.21	15.38
		Generic Elective Courses (GE)	24	16.21	15.38
3	Ability Enhancement Courses (AEC)	Ability Enhancement Compulsory Courses (AEC)	8	5.40	7.69
		Ability Enhancement Elective (Skill Based) (SEC)	8	5.40	7.69
			148	100	100

Table 1 (% age of courses for first three years of the Programme)

Course Structure (Chemistry Major)

Courses	Credits*	Credits*
	Theory+ Practical	Theory + Tutorial
I. Core Course	14×4 = 56	14×5 = 70
(14 Papers)		
Core Course Practical / Tutorial*		
(14 Papers)	14×2 = 28	14×1= 14
II. Elective Course		
(8 Papers)		
A.1. Discipline Specific Elective	$4 \times 4 = 16$	$4 \times 5 = 20$
(4 Papers)		
A.2. Discipline Specific Elective		
Practical/Tutorial*	$4 \times 2 = 08$	$4 \times 1 = 04$
(4 Papers)	1	11 - 0.1
B.1. Generic Elective/Interdisciplinary	4×4 = 16	$4 \times 5 = 20$
(4 Papers)		
B.2. Generic Elective	$4 \times 2 = 08$	$4 \times 1 = 04$
Practical/ Tutorial*		
(4 Papers)		
optional Dissertation or project work in place o credits) in 6 th Semester	t one Discipline Specific E	elective paper (6
III. Ability Enhancement Courses		
1. Ability Enhancement Compulsory**	2×4 = 08	2×4 = 08
(2 Papers of 4 credit each)		
Environmental Science/		
English/		
MIL Communication/Sanskrit		
2. Ability Enhancement Elective	$2 \times 4 = 08$	$2 \times 4 = 08$
(Skill Based) (Minimum 2)		
(2 Papers of 4 credit each)		
Total credit	148	148
University should evolve a sys	stem/policy about ECA	/ General Interest/

HODDY/ Sports/ NUC/ NSS/ related courses on its own. *Wherever there is a practical there will be no tutorial and vice-versa.,

** University/Department may include more options or delete some from this list. The courses will be offered according to faculty strength and as per availability of faculty members.

NOTE: MOOC courses (SWAYAM) having similarity more than 75% with the core course may be offered to the students. For elective courses (whatever nomenclature may be used), the students may opt from the MOOC courses provided these courses are not in the list of core course (SWAYAM) keeps changing, the departmental committee is authorized to finalize the list of MOOC courses for each semester based on the above criteria.

3. SEMESTER-WISE COURSES AND CREDIT DISTRIBUTION

(for first three years)

First Year

Sr. No.	Course No.	Course Name	Course Code Course Type (Opted)		L Hr	T s.	Р	Credit
Sen	nester I		·					
1		Inorganic Chemistry-I	SBS CH 020101 C 3104	сс	3	1	0	4
2		Inorganic Chemistry Practical-I	SBS CH 020102 C 0042	сс	0	0	4	2
3		Organic Chemistry-I	SBS CH 020103 C 3104	сс	3	1	0	4
4		Organic Chemistry Practical-I	SBS CH 020104 C 0042	СС	0	0	4	2
5		From the list of courses available (any one)	AEC-1		3	1	0	4
6		From the list of courses available (any one)	SEC-1		2	0	0	2
7		Offered by other Departments	GE		3	1	4	6
					To	tal (Cred	it 24
Sen	nester I	l i i i i i i i i i i i i i i i i i i i						
1		Physical Chemistry-I	SBS CH 020201 C 3104	сс	3	1	0	4
2		Physical Chemistry Practical-I	SBS CH 020202 C 0042	сс	0	0	4	2
3		Organic Chemistry-II	SBS CH 020203 C 3104	СС	3	1	0	4
4		Organic Chemistry Practical-II	SBS CH 020204 C 0042	СС	0	0	4	2
5		From the list of courses available (any one)	AEC-2		3	1	0	4
6		From the list of courses available (any one)	SEC-2		2	0	0	2
7		(Offered by other Departments	GE	-	3	1	4	6
					То	tal (Cred	it 24

CC = Core Course; AEC = Ability Enhancement Course; SEC = Skill Enhancement Course; GE = Generic Elective Course; (or students may choose any one from the given list)

In addition to the courses students will be trained for Seminars, Group Discussions and Individual/Team Projects throughout the semesters.

Second Year

Sr. No.	Course No.	Course Name	Course Code	Course Type	L	Τ	Р	Credit	
				(Opted)	Hr	'S.	•		
Ser	nester	II							
1		Physical Chemistry-II	SBS CH 020301 C 3104	сс	3	1	0	4	
2		Physical Chemistry Practical-II	SBS CH 020302 C 0042	СС	0	0	4	2	
3		Organic Chemistry-III	SBS CH 020303 C 3104	СС	3	1	0	4	
4		Organic Chemistry Practical-III	SBS CH 020304 C 0042	СС	0	0	4	2	
5		Molecular Spectroscopy and Photochemistry	SBS CH 020305 C 3104	сс	3	1	0	4	
6		Spectroscopy Practical	SBS CH 020306 C 0042	СС	0	0	4	2	
7		Offered by other Departments	GE		3	1	4	6	
					Tot	al Cr	edit	24	
Ser	nester	IV							
1		Physical Chemistry-III	SBS CH 020401 C 3104	сс	3	1	0	4	
2		Physical Chemistry Practical-III	SBS CH 020402 C 0042	сс	0	0	4	2	
3		Inorganic Chemistry-II	SBS CH 020403 C 3104	СС	3	1	0	4	
4		Inorganic Chemistry Practical-II	SBS CH 020404 C 0042	СС	0	0	4	2	
5		Introduction to Quantum Chemistry	SBS CH 020405 C 3104	СС	3	1	0	4	
6		Quantum Chemistry Practical	SBS CH 020406 C 0042	СС	0	0	4	2	
7		Offered by other Departments	GE		3	1	4	6	
					Tot	Total Credit 24			

<mark>CC =</mark> Core Course; AEC = Ability Enhancement Course; SEC = Skill Enhancement Course; GE = Generic Elective Course; (or students may choose any one from the given list)

In addition to the courses students will be trained for Seminars, Group Discussions and Individual/Team Projects throughout the semesters.

Third Year

Sr.	Course	Course Name	Course Code	Course	L	Т	Р	Credit	
No.	No.			Type (Opted)	Hr	'S.			
-				(Opteu)		01			
Ser	nester	V							
1		Inorganic Chemistry-III	SBS CH 020501 C 3104	СС	3	1	0	4	
2		Inorganic Chemistry Practical-III	SBS CH 020502 C 0042	сс	0	0	4	2	
3		Analytical Chemistry	SBS CH 020503 C 3104	СС	3	1	0	4	
4		Analytical Chemistry Practical	SBS CH 020504 C 0042	СС	0	0	4	2	
5		From the list of courses available	SEC-3	-	2	0	0	2	
6		From the list of courses available	DSE-1			1	0	4	
7		From the list of courses available	Practical (DSE-1)			0	4	2	
8		From the list of courses available	DSE-2		3	1	0	4	
9		From the list of courses available	Practical (DSE	E- 2)	0	0	4	2	
					To	tal Cr	Credit 26		
Ser	nester	VI							
1		Green Chemistry	SBS CH 020601 C 3104	сс	3	1	0	4	
2		Green Chemistry Practical	SBS CH 020602 C 0042	сс	0	0	4	2	
3		Materials Chemistry	SBS CH 020603 C 3104	СС	3	1	0	4	
4		Materials Chemistry Practical	SBS CH 020604 C 0042	СС	0	0	4	2	
5		From the list of courses available	SEC-4		2	0	0	2	
6		From the list of courses available	DSE-3		3	1	0	4	
7		From the list of courses available	Practical (DSE	-3)	0	0	4	2	
8		From the list of courses available	DSE-4		3	1	0	4	
9		From the list of courses available	Practical (DSE	-4)	0	0	4	2	
					To	26			

<mark>CC</mark> = Core Course; <mark>SEC</mark> = Skill Enhancement Course; DSE = Discipline Specific Elective Course; (or students may choose any one from the given list)

In addition to the courses students will be trained for Seminars, Group Discussions and Individual/Team Projects throughout the semesters.

Note:

- 1. AEC, SEC, DSE and GE courses will be offered according to faculty strength and as per the availability of faculty members.
- 2. The University/Department may add/delete courses from time to time as per requirement.
- 3. The entry and exit in the Integrated B.Sc.-M.Sc. programme will be decided according the relevant University Ordinance.

LIST of COURSES

Core Papers (C): (Credit: 06 each) (3 periods + 1 tutorial/week for theory and 4 periods/week for practical)

- 1. Inorganic Chemistry I (4 + 4)
- 2. Organic Chemistry I (4 + 4)
- 3. Physical Chemistry I (4 + 4)
- 4. Organic Chemistry II (4 + 4)
- 5. Physical Chemistry II (4 + 4)
- 6. Organic Chemistry III (4 + 4)
- 7. Molecular Spectroscopy and Photochemistry (4+4)
- 8. Physical Chemistry III (4 + 4)
- 9. Inorganic Chemistry II (4 + 4)
- 10. Introduction to Quantum Chemistry (4 + 4)
- 11. Inorganic Chemistry III (4 + 4)
- 12. Analytical Chemistry (4 + 4)
- 13. Green Chemistry (4 + 4)
- 14. Materials Chemistry (4 + 4)

Discipline Specific Elective (DSE) Papers: (Credit: 06 each) (3 periods + 1 tutorial/week for theory and 4 periods/week for practical)

- 1. Medicinal Chemistry
- 2. Electrochemistry
- 3. Electrochemistry Practical
- 4. Advanced Analytical Chemistry
- 5. Organic Spectroscopy
- 6. Heterocyclic Chemistry
- 7. Organometallics and Bioinorganic chemistry
- 8. Introduction to Nanochemistry & applications
- 9. Dissertation (To be taken as optional in place of one DSE course)

Ability Enhancement (AEC) Papers: (Credit: 04 each) (3 periods + 1 tutorial/week)

- 1. English for Communication
- 2. History of Indian Science
- 3. Good Laboratory Practices
- 4. Cheminformatics
- 5. Research methodology
- 6. Chemistry in Everyday life

Skill Enhancement (SEC) Papers: (Credit: 02 each) (2 periods week)

- 1. Personality Development
- 2. Computer Applications in Chemistry
- 3. Science Communication and
- 4. Popularization
- 5. Biofertilizer
- 6. Herbal Science & Technology
- 7. Fermentation Science & Technology
- 8. Environment Impact Analysis

Generic Elective (GE) Papers: (Credit: 06 each) (3 periods + 1 tutorial/week for theory and 4 periods/week for practical)

- 1. GE: Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons
- 2. GE: Chemical Energetics, Equilibria & Functional Organic Chemistry-I
- 3. Solutions, Phase Equilibria, Conductance, Electrochemistry, & Functional Group Organic Chemistry
- 4. GE: Transition Metal & Coordination Chemistry, States of Matter & Chemical Kinetics
- 5. Organometallics, Bio-inorganic Chemistry, Polynuclear Hydrocarbons & UV, IR Spectra
- 6. GE: Quantum Chemistry, Spectroscopy & Photochemistry
- 7. Molecules of Life
- 8. Chemistry of Main Group Elements, Theories of Acids & Bases

Note:

- 1. University/Department may include more options or delete some from this list.
- 2. The courses will be offered according to faculty strength and as per availability of faculty members.

4. COURSES

Semester I

Course I	No: Course Name: Course Code:									
		Inorganic Chemistry	y-l	1	1	SBS CH 02	20101 C 310)4		
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact H	Irs.	
2022		Integrated B.Sc						per Weel	C :	04
onwards	S	M.Sc. Chemistry	1	3	1	0	4	Total Hrs	.:	60
Total Ev	aluatio	n Marks: 100	Examinatio	n Duration:		3 Hrs.				
CIE: 3	30 Mar	ks	Pre-requisit	e of course	Basic kn	iowledge al	oout atom	ic structur	e, che	mical
TEE: 7	70 Marl	ks	bonuing, pe	riouic proper	ties and i	euuxreacu	0115.			
Course		To provide basic kn	owledge abo	ut atomic sti	ructure, q	uantum me	chanics, du	ual nature	of par	ticles,
Objectiv	<i>ie</i>	bonding aspect, ele	ctrode poten	tial etc.						
Course		After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:			
Outcom	es:	CO1: Understandin	g about wave	function						
		CO2: Understand t	he periodicit	y in atomic	and ionic	: radii, elec	tronegativ	ity, ionizat	ion er	nergy,
	electron affinity of elements of the periodic table									
	CO3 : Understand the importance and application of chemical bonds, inter-molecular and									
		Intramolecular wea	k chemical fo	orces and the	ir effect.	otontial and	l volumotr	ie opolycie		
		CO4: In-depth know	vieuge about	stanuaru ele	rious rule			honding		
		COS. Ability to unue	g of anomalo	us behaviour	of eleme	nts	Chemican	oonung		
					ABUS	1105				
NOTE										
i) Ouesti	ion no	1 is compulsory and	to be set from	n tha antira	syllabur. I	t will have c	ovon cub i	parts and s	tudoni	tc
need to	answei	any four Each part	carries three	and half mar	synabus. i ·kc	t will lidve S	even sub-	Jai ls anu s	tuuem	15
ii) Quest	tion no	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will hav	ve three su	b-part	ts and
students	s need t	to answer any two su	ub-parts of ea	ch question.	Each part	carries sev	en marks.		, part	
Unit			•	Contents	•				Con	tact
No.									H	rs.
I	ΑΤΟΜ	IC STRUCTURE							1	.5
	Bohr's Broglie	theory, its limitatior e equation, Heisenb	is and atomic erg's Uncerta	spectrum o ainty Princip	f hydroge le and it	n atom. Wa s significan	ave mecha ice, Schrö	nics: de dinger's		
	wave	equation, significant	ce of ψ and wave function	ψ^2 . Quant	tum num	bers and t	their signi	ficance.		
	functio	ins for hydrogen ato	m. Radial an	d angular di	stribution	curves. Sha	apes of s, p	<i>b, d</i> and		
	f orbita	als. Contour boundar	y and probat	oility diagran	ns.					
	Pauli's	Exclusion Principle,	Hund's rule (of maximum	multiplic	ty, Autbau	s principie	and its		
			ntal energy v	VILLI ALOMIC I	iumper.				1	5
"	s.n.d	f block elements the	long form of	f periodic tak	le. Detail	ed discussio	on of the fo	llowing	T	د.
	proper	ties of the elements	, with referen	nce to s and	o-block.					
					-					

	(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective	
	nuclear charge in periodic table.	
	(b) Atomic radii (van der Waals)	
	(c) Ionic and crystal radii.	
	(d) Covalent radii (octahedral and tetrahedral)	
	(e) Ionization enthalpy, Successive ionization enthalpies and factors affecting	
	ionization energy. Applications of ionization enthalpy.	
	(f) Electron gain enthalpy, trends of electron gain enthalpy	
	(g) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's	
	electronegativity scales. Variation of electronegativity with bond order, partial charge,	
	hybridization, group electronegativity. Sanderson's electron density ratio	
III	CHEMICAL BONDING-I	15
	(i) <i>Jonic bond</i> : General characteristics, types of jons, size effects, radius ratio rule and its	
	limitations. Packing of jons in crystals. Born-Landé equation with derivation and	
	importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber	
	cycle and its application. Solvation energy.	
	(ii) <i>Metallic Bond</i> : Qualitative idea of valence bond and band theories. Semiconductors	
	and insulators, defects in solids.	
	(iii) Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole	
	interactions, induced dipole interactions. Instantaneous dipole-induced dipole interactions	
	Repulsive forces. Hydrogen bonding (theories of hydrogen bonding, valence bond treatment)	
	Effects of chemical force melting and boiling points, solubility energetics of dissolution	
	nrocess	
IV		15
IV	CHEMICAL BONDING-II AND OXIDATION-REDUCTION	15
IV	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule	15
IV	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Besonance and resonance energy. Molecular orbital theory. Molecular orbital diagrams of	15
IV	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules Na Oa Ca Ba Ea CO NO and their ions: HCl	15
IV	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N ₂ , O ₂ , C ₂ , B ₂ , F ₂ , CO, NO, and their ions; HCl, BoE CO (idea of s-n mixing and orbital interaction to be given). Formal charge Valence	15
IV	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N ₂ , O ₂ , C ₂ , B ₂ , F ₂ , CO, NO, and their ions; HCl, BeF ₂ , CO ₂ , (idea of <i>s-p</i> mixing and orbital interaction to be given). Formal charge, Valence shall electron pair repulsion theory (VCEDR) shapes of simple melocules and ions containing	15
IV	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N ₂ , O ₂ , C ₂ , B ₂ , F ₂ , CO, NO, and their ions; HCl, BeF ₂ , CO ₂ , (idea of <i>s-p</i> mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing long pairs and hand pairs of electrons. multiple bonding (g and g bond approach) and	15
IV	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N ₂ , O ₂ , C ₂ , B ₂ , F ₂ , CO, NO, and their ions; HCl, BeF ₂ , CO ₂ , (idea of <i>s-p</i> mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and hond lengths	15
IV	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N ₂ , O ₂ , C ₂ , B ₂ , F ₂ , CO, NO, and their ions; HCl, BeF ₂ , CO ₂ , (idea of <i>s-p</i> mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths.	15
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IV Sugges	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2 , O_2 , C_2 , B_2 , F_2 , CO, NO, and their ions; HCl, BeF ₂ , CO ₂ , (idea of <i>s-p</i> mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference. Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class. ted Readings: Atkins, P.W. & Paula, J. Physical Chemistry, 10th Edition. Oxford University Press, 2014.	15
IV Sugges 1. 2.	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N ₂ , O ₂ , C ₂ , B ₂ , F ₂ , CO, NO, and their ions; HCl, BeF ₂ , CO ₂ , (idea of <i>s-p</i> mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference. Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class. ted Readings: Atkins, P.W. & Paula, J. Physical Chemistry, 10th Edition, Oxford University Press, 2014. Rodger, G.E. Inorganic and Solid State Chemistry. Cengage Learning India Edition, 2002.	15
IV Sugges 1. 2. 3.	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2 , O_2 , C_2 , B_2 , F_2 , CO, NO, and their ions; HCl, BeF ₂ , CO ₂ , (idea of <i>s-p</i> mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference. Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class. ted Readings: Atkins, P.W. & Paula, J. Physical Chemistry, 10th Edition, Oxford University Press, 2014. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.	15
IV Sugges 1. 2. 3. 4.	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N ₂ , O ₂ , C ₂ , B ₂ , F ₂ , CO, NO, and their ions; HCl, BeF ₂ , CO ₂ , (idea of <i>s-p</i> mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference. Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class. tted Readings: Atkins, P.W. & Paula, J. Physical Chemistry, 10th Edition, Oxford University Press, 2014. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford. 19	15
IV Sugges 1. 2. 3. 4. 5.	CHEMICAL BONDING-II AND OXIDATION-REDUCTION <i>Covalent bond:</i> Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N ₂ , O ₂ , C ₂ , B ₂ , F ₂ , CO, NO, and their ions; HCl, BeF ₂ , CO ₂ , (idea of <i>s-p</i> mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference. Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class. ted Readings: Atkins, P.W. & Paula, J. Physical Chemistry, 10th Edition, Oxford University Press, 2014. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 19 Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.	15

Course No:	Course Name:	Course Name: Course Code:						
	Inorganic Chemistr	y Practical-I	1	1	SBS CH 02	20102 C 004	42	
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact Hrs.	
2022	Integrated B.Sc						per Week:	04
onwards	M.Sc. Chemistry	I	0	0	4	2	Total Hrs.:	60
Total Evalua	tion Marks: 50	Examinatio	n Duration:	6 Hrs.				
CIE: 15 M	arks	Pre-requisit	e of cours	e: Skill to	handle pr	eparation	of various so	olutions,
TEE: 35 M	arks	estimation of	of metal ion	s in the sar	nple during	performin	ng experiments	
Course	To acquire the skills	to know abo	ut titrimetri	c analysis,	acid-base t	itrations a	nd oxidation-re	eduction
Objective	ective titrimetry during the experiments. Also to carry out separation of mixtures of inorganic compounds by different methods.							
Course	After completing th	nis course, stu	dent is expe	ected to lea	arn the follo	wing:		
Outcomes:	CO1: Basic knowled	lge of inorgar	nic preparati	ion				
	CO2: Preparation of	f various solu	utions					
	CO3: Separation of	ions from the	e mixtures					
	CO4: Estimation of ions from the mixtures							
	CO5: Knowledge about indicators							
-	CO6: 10 work-up, is	solate and pu	rity, determ	ine the pu	nty of the p	repared co	ompound	
		(COURSE SYL	LABUS				
NOTE:								
I wo questio	ns will be set, one from	each of the l	JNII. The ca	ndidates a	re required	to attemp	ot all the questi	ons.
Unit No.			Content	S			Ľ	Hrs.
1	TITRIMETRIC ANALYSI	5						35
(1) Calibration and use	of apparatus						
(1	i) Preparation of soluti	ons of differe	ent Molarity	/Normality	y of titrants	5		
	ACID-BASE TITRATION	5						
() Estimation of carbor	ate and hydr	oxide prese	ent togethe	er in mixtur	e.		
(i) Estimation of carbor	ate and bica	rbonate pre	sent toget	her in a mix	xture.		
(ii) Estimation of free a	Ikalı present	in different	soaps/det	ergents			
			KY .					25
	(I) Estimation of Fe(II) a	and oxalic aci	d using stan	idardized i	(IVINO ₄ solu mixturo	tion.		
	(ii) Estimation of Eq(II)	aciu aliu sou With K Cr C		rnal (dint	onvlamine.	anthranil	lic acid)	
	and external indicator	1 with $K_2 C C_2 C$	7 using inte		ienyianine,	antinann		
Suggested R	eadings:							
1. J. Me	ndham, A. I. Vogel's Ou	antitative Ch	emical Ana	lysis 6 th Ed	ition, Pears	on, 2009.		
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Course No	: Course Name: Organic Chemistry-	Course Name: Course Code: Organic Chemistry-I SBS CH 020103 C 3104						
Batch:	Programme:	Semester:	L	Т	P	Credit	Contact H	lrs.
2022	Integrated B.Sc						per Week	: 04
onwards	M.Sc. (Chemistry)	I	3	1	0	4	Total Hrs	: 60
Total Eval	uation Marks: 100	Examination	Duration:		3 Hrs.			
CIE: 30	Marks	Pre-requisite	of course	: Basic kno	owledge of	chemical st	tructures of	the simple
TEE: 70	Marks	organic comp	ounds.					
Course Objective	To provide basic known and substitution re aromatic hydrocarb	owledge of org actions, stered ons , cycloalka	anic chem ochemistry ines and co	nistry, rea and basic onformatio	ctions such c chemistry onal analys	as additior of alkanes is.	n reactions, s, alkenes, c	elimination alkynes and
Course	After completing th	is course, stud	ent is expe	ected to le	arn the foll	owing:		
Outcomes	: CO1: Thorough kno	wledge of basi	cs of organ	nic chemis	try			
	CO2: Basic understa	inding of stere	ochemistr ad alkonos	У				
	CO3 : Basic chemistry of alkanes and alkenes CO4 : Ability to understand, explain and predict various aspects of cycloalkanes and conformational							
	analysis.							
		COL	JRSE SY	LABUS				
ΝΟΤΕ·								
i) Question	n no. 1 is compulsory and	to be set from	the entire	syllabus.	It will have	seven sub-	parts and st	udents
need to ar	iswer any four. Each part	carries three a	nd half ma	, irks.			•	
ii) Questio	n nos. 2 to 5 are to be set	from all four u	inits one fi	rom each.	Every ques	tion will ha	ve three su	b-parts and
students n	eed to answer any two su	b-parts of eac	h question	. Each par	t carries se	ven marks.		
Unit No.			Contents					Contact Hrs.
I B/	ASICS OF ORGANIC CHEN	IISTRY						15
Oi In	ganic Compounds: Classi fluence of hybridization c	fication, and N on bond prope	omenclatu rties.	ure, Hybrid	dization, Sh	apes of mo	plecules,	
El	ectronic Displacements:	Inductive, el	ectromerio	c, resona	nce and n	nesomeric	effects,	
hy	perconjugation and the	ir application	s; Dipole	moment	; Organic	acids and	l bases;	
th	eir relative strength.					c ,		
	omolytic and Heterolytic f	ission with sur	table exan	nples. Curl	ly arrow rul	es, formal (charges;	
El st.	ability of Carbocations	arbanions Fre	e radicals	and Carbe	ypes, snap mes	e and their	relative	
In	troduction to types of o	rganic reactio	ns and the	neir mech	ianism: Ad	dition, Elir	nination	
ar	d Substitution reactions.							
Fo	ormulae representation: F	ischer Projecti	on, Newm	ann and S	Sawhorse P	rojection f	ormulae	
ar	d their interconversions							4 -
	EKEUCHEMISIKY	rism Geometr	ical isomo	rism: cic	trans and	syn-anti id	omericm	15
F/	Z notations with C.I.P rule	es.			tians diù,	syn-anti Is	501112115111	
0	otical Isomerism: Optical	Activity, Spec	cific Rotat	ion, Chira	lity/Asymm	netry, Enar	ntiomers,	
M	olecules with two or mo	ore chiral-cent	res, Diast	ereoisome	ers, meso	structures,	Racemic	
m	ixture and resolution. Rel	ative and abso	olute confi	guration:	D/L and R/	S designati	ons.	

	Cycloalkanes and Conformational Analysis: Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.	
111	 ALKANES AND ALKENES Carbon-Carbon sigma bonds: Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity. Carbon-Carbon pi bonds: Formation of alkenes and alkynes by elimination reactions Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene. 	15
IV	ALKYNES AND AROMATIC HYDROCARBONS Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes. Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.	15
Sugge	ested Readings:	
1.	J. Singh, L.D.S. Yadav, Organic Chemistry (Volume I), 14 th Edition, Pragati Prakashan, 2019.	
2.	S. M. Mukherji and S. P. Singh, Reaction Mechanism in Organic Chemistry, Revised Edition. (Rev Singh and Om Prakash). TRINITY Press, An Imprint of Laxmi Publications Pvt. Ltd., 2015.	vised by S. P.
3. 4.	R. N. Boyd, R. T. Morrison and S. K. Bhattcharjee, Organic Chemistry, 7 th Edition, Pearson, 2014. S. M. Mukerji, S. P. Singh, K.P. Kapoor and R. Das, Organic Chemistry (Volume III), 2 nd Editio International Publishers, 2014.	on, New Age
5.	J. E. McMurry, Fundamentals of Organic Chemistry, 7 th Edition, Cengage Learning India, 2013	3.
6.	S. M. Mukerji, S. P. Singh, K.P. Kapoor and R. Das, Organic Chemistry (Volume II), 2 nd Editio International Publishers, 2012.	n, New Age
7.	S. M. Mukerji, S. P. Singh, K.P.Kapoor and R. Das, Organic Chemistry (Volume I), 2 nd Editio International Publishers, 2010.	n, New Age
8.	P. S. Kalsi, Stereochemistry Conformation and Mechanism, New Age International, 2005.	
9.	I. L. Finar, Organic Chemistry (Volume 1), 6 th Edition, Pearson, 2002.	1 . <u>1 -</u> +h
10	J. I. L. Finar, Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural P Edition, Pearson, 2002.	roducts), 5 ^m

11. E. L. Eliel & S. H. Wilen, Stereochemistry of Organic Compounds, Wiley: London, 1994.

Course No:	Course Name:	Dractical			Course Co	ode:	40	
Patch	Drganic Chemistry	Somostor:		т	SBS CH U2		42	**
2022	Integrated B Sc -	Semester.	L .	•	r	Credit		· 02
onwards	M.Sc. Chemistry	1	0	0	Δ	2	Total Hrs	. 02 60
Total Evalua	ation Marks: 50	•	U	U		2	rotarins.	00
CIE: 15 N	/larks	Examinatio	n Duration:	6 Hrs.				
TEE: 35 Marks		Pre-requisit	e of course	: Commor	n understan	ding of che	emicals.	
Course Objective	To inculcate the co b.p. determination,	mmon skills i crystallizatio	required for n and separ	performin ation of co	g organic c mpounds b	hemistry p y thin laye	practicals lik r chromato <u>c</u>	e m.p. and graphy.
Course Outcomes:	CourseAfter completing this course, student is expected to learn the following:Dutcomes:CO1: About the calibration of thermometer and its usesCO2: Determination of b.p. and m.p. of the organic compounds purification of organic compoundsCO3: About the use of thin layer chromatography							
		CC	URSE SYI	LABUS				
NOTE:								
Two questic	ons will be set, one from	each of the l	JNIT. The ca	ndidates a	ire required	to attemp	ot both ques	tions.
Unit No.			Content	ts				Contact Hrs.
I	1. Checking the calibra	tion of the th	nermomete	r				30
	2. Purification of organ	nic compound	ds by crysta	llization us	sing the foll	owing solv	vents:	
	a) Water							
	b) Alcohol							
	2 Determination of t	ha malting	noints o	fabovo	compound	hac ah	unknown	
	organic compounds (Ki	eldahl metho	od and elect	rically hea	ited melting	noint and	paratus)	
11	4.Effect of impurities	on the melt	ing point -	mixed m	elting poir	t of two	unknown	30
	organic compounds		01		0 1			
	5.Determination of bo	iling point o	f liquid con	npounds.	(boiling po	int lower	than and	
	more than 100 °C by di	stillation and	l capillary m	nethod)				
	6.Chromatography							
	a. Separation of a mi	xture of two	o amino ac	ids by as	cending an	d horizont	tal paper	
	chromatography	turo of two o	ugare by ac	conding a	nor chrom	atography		
	c Separation of a mix	ture of a-a	ugais by ds nd <i>n</i> -nitron	henol or	o-and o-ar	ninonheno	bl hv thin	
	layer chromatography	(TLC)					. Sy chin	

Suggested Readings:

1. B.S. Furniss ; A. J. Hannaford ; P.W.G. Smith ; A. R. Tatchell, Practical Organic Chemistry, 5th Edition., Pearson, 2012.

2. F.G. Mann & B.C. Saunders, Practical Organic Chemistry, Pearson, 2009.

Semester II

Course	No:	Course Name:		Course Code:						
		Physical Chemistry	'-l			SBS CH 0	20201 C 3	104		
Batch:		Programme:	Semester:	L	Т	Р	Credit	Contact Hr	s.	
2022		Integrated B.Sc						per Week:		4
onward	S	M.Sc.(Chemistry)	11	3	1	0	4	Total Hrs.:		60
Total Ev	/aluati	on Marks: 100	Examinatio	n Duration	:	3 Hrs.				
CIE:	30 Ma	rks	Dro_roquisit	e of cours	e. Knowled	dae of has	ic physical	chemistry c	our	a un
TEE:	70 Ma	rks	to Sen. Sec. level.							
Course	urse To provide students with a basic understanding of physical chemistry, gaseous, liquid and solia							solid		
Objectiv	ectives state and ionic equilibria. This course will strengthen the fundamentals of physical chemistry,							istry,		
		especially gaseous	state, liquid	state and s	olid state.					
Course		After completing t	his course, st	udent is ex	pected to	learn the f	following:			
Outcom	nes:	CO1 : Basic underst	anding of ph	ysical chen	nistry.					
		CO2 : Use of gaseo	us, liquid and	l solid-state	e techniqu	es in daily	lite.			
		CO3 : Skills for anal	yzing and de	veloping ne	ew sustain	able meth	ods.			
		CO4: Skills for deve	eloping indus	trially impo	ortant met	noas.				
		COS: Development	cod and roco	nt techniqu	li methous	Vical chemi	ictry			
					les in phys		istiy.			
			CC	OURSE SYL	LABUS					
NOTE:										
i) Quest	tion no	. 1 is compulsory ar	d to be set f	rom the en	tire syllabı	us. It will h	ave seven	sub-parts a	nd	
student	S									
need	to ans	wer any four. Each	part carries t	hree and h	alf marks.					
II) Ques	stion n	os. 2 to 5 are to be	set from all	four units	one from e	each. Ever	y questior	n will have th	hree	sub-
parts an	ia stua	ents need to answe	er any two su	D-parts of Cont	each quest		part carrie	es seven mar	кs. Сог	atact
No				Conto	ents				н	Irc
1	GASEC	US STATE								15
•	Kinetic	molecular model o	f a gas: post	ulates and	derivation	n of the ki	netic gas	equation:	-	1.5
	collisic	on frequency: collisi	ion diameter	: mean fre	e path and	d viscositv	of gases.	including		
	their t	emperature and p	ressure dep	endence. I	relation be	etween m	ean free	path and		
	coeffic	ient of viscosity, ca	Iculation of	σ from η ;	variation of	of viscosity	/ with ter	nperature		
	and pr	essure.		17						
	Maxw	ell distribution and	d its use in	evaluatin	g molecul	ar velocit	ies (aver	age, root		
	mean	square and most p	robable) an	d average	kinetic en	ergy, law	of equipa	rtition of		
	energy	r, degrees of freedo	m and mole	cular basis	of heat ca	pacities.				
	Behavi	or of real gases: D	Deviations fr	om ideal g	gas behavi	or, compr	essibility	factor, Z,		
	and its	s variation with p	ressure for	different g	gases. Cau	ses of de	eviation fi	rom ideal		
	behavi	or. Van der Waals	equation of	state, its c	lerivation	and applic	cation in e	explaining		
	real g	as behavior, ment	ion of othe	er equatio	ns of sta	te (Berth	elot, diel	ectric or		
	Dieter	ci); virial equation	of state; van	der Waals	s equation	expresse	d in virial	form and		

	calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.	
II	LIQUID STATE Qualitative treatment of the structure of the liquid state; Radial distribution function; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases. Qualitative discussion of structure of water. Different bonding present in solid and liquid state of water. Difference in structure of liquid and solid state of water.	15
111	SOLID STATE Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals. Glasses and liquid crystals.	15
IV	IONIC EQUILIBRIA Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids (exact treatment). Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations. Multistage equilibria in polyelectrolyte systems; hydrolysis and hydrolysis constants.	15

Suggested Readings:

1. P. W. Atkins, and J. D. Paula, Atkin's Physical Chemistry, 10th Edition, Oxford University Press (2014).

- 2. T. Engel, and P. Reid, Physical Chemistry 3rd Edition, *Pearson* (2013).
- R. G. Mortimer, Physical Chemistry 3rd Edition, *Elsevier*, NOIDA, UP (2009).
 D. W. Ball, Physical Chemistry, *Thomson Press*, India (2007).
- 5. G. W. Castellan, Physical Chemistry 4th Edition, *Narosa Publication House* (2004).

Course	e No:	Course Name:	Practical		Course Code:					
Batch		Programme:	Somostor:	1	т	р	Cradit		<u> </u>	
2022		Integrated B Sc -	Semester.	L		F	Credit	per Week	3.	
onwar	ds	M Sc (Chemistry	П	0	0	1	2	Total Hrs ·		60
Total	us Ivaluati	on Marks: 50		0	0	4	2	10(4)1115		00
Total	valuati		Examinatio	n Duratior	ו:	6 Hrs.				
CIE:	15 Ma	rks	Pre-requisi	Pre-requisite of course: Knowledge of solution preparation, safety						
			measure in	chemistry	practical	aboratory	and basic	c practical kr	owle	edge
TEE:	35 Ma	rks	up to Sen. S	Sec. level.						
Course To provide stude			nts with a bo	asic under	standing o	f laborato	ry technic	ques. This co	urse	: will
Object	Objectives strengthen the fu			f analytica	l chemistry	, and basic	s of physic	cal chemistry	prac	ctical
-	techniques.									
Course	9	After completing t	his course, si	tudent is e	xpected to	learn the	following:			
Outco	mes:	CO1 : Basic unders	tanding of pr	iysical che	mistry prac	cical.	in daily li	fo		
		CO3 : Skills for ana	lyzing and de	scosity and weloning r	ew sustair	able meth	nds	ie.		
		CO4 : Skills for dev	eloning indu	strially imr	ortant pra	ctical met	hods.			
		CO5 : Developmen	t of alternate	e testing m	ethods.					
CO6 : Use of advanced and recent techniques in experimental chemistry.										
			CC	OURSE SY	LLABUS					
NOTE	Donon	ding on availabil	ity of time '	and pauir	mont's s	omo ovn	arimonte	may be ad	hah	/
NOTL.	delete	d.		anu equip	Jiiieiit 3, 3	onie exp	erments	may be au	ueu/	/
Unit				Cont	tents				Cor	ntact
No.									Н	irs.
I	Surf	ace tension and Vis	cosity Meas	urements.					3	30
	a. De	termine the surface	tension by ((i) drop nu	mber (ii) d	rop weigh	t method.			
	b. Sti	idy the variation of	of surface	tension	of deterge	ent solut	ions with	n		
	c Det	ncentration.	sity of aque	us solutio	ns of (i) no	lumer (ii)	othanol a	nd(iji)		
	sugar	chillination of visco	sity of aqueo	Jus solutio		nymer (ii)	cthanor a	liiu(iii)		
	at	room temperature.								
	d. Stu	udy the variation o	f viscosity o	of sucrose	solution w	ith the co	ncentratio	n of		
	solute.									
П	Indexi	ng by powder diffr	action metho	od of a cub	ic crystalli	ne system	•		З	30
	a. Finc	ling Miller indices o	f unknown X	RD using J(CPDS card f	ile.				
	b. Det	ermination of avera	ge particle si	ize using So	cherrer equ	lation.				
	pH n	netry				1	<i>.</i>	1 1'		
	a. Sti	and the effect on pH	of addition	OF HCI/N	aOH to so	iutions of	acetic aci	a, sodium		
	h Pr	enaration of buffer	ures.	different n	н					
	i.	Sodium acetate-acet	ic acid	unicient p	11					
	ii.	Ammonium chlorid	e-ammoniun	n hydroxid	le					
	c pH	metric titration of (i) strong acid	vs. strong	base, (ii)	weak acid	vs. strong	base.		
	e. pm		-		, , , ,		· · · · · · · · ·	,		

Suggested Readings:

1. R. Gupta, Practical Physical Chemistry, New Age International Pub. House, New Delhi (2017).

2. B. D. Khosla, V. C. Garg, and A. Gulati, Senior Practical Physical Chemistry, *R. Chand & Co.*, New Delhi (2011).

3. C. W. Garland, J. W. Nibler, and D. P. Shoemaker, Experiments in Physical Chemistry, 8th Edition; McGraw-Hill, New York (2003).

4. A. M. Halpern, and G. C. Mc. Bane, Experimental Physical Chemistry 3rd Edition, W.H. Freeman & Co., New York (2003).

Course	e No:	Course Name:	Course Name:					Course Code:				
Datah		Dreammer	Comostor.		-			Contoct Ura				
Datch:		Programme:	semester:	L	1	P	Credits		. 04			
2022	dc	M Sc. Chemistry	п	2	1	0	Л	Total Urs :	60			
	us	n Markey 100	11	5	L	0	4		60			
TOLAT	valuatio	n Warks: 100	Examinatio	n Duration:		3 Hrs.						
CIE:	30 Mar	<s< td=""><td colspan="8">Pre-requisite of course: Knowledge of chemistry of halogenated hydrocarbons,</td></s<>	Pre-requisite of course: Knowledge of chemistry of halogenated hydrocarbons,									
TEE:	70 Marl	۲S	preparation reactions of	and propert carbonyl cor	ies of alcompounds,	ohols, pheno carboxylic a	ols, ethers acids and t	and epoxides heir derivativ	, addition es.			
Course	?	To provide studer	ts with bas	ic understa	nding of	, chemistry	of haloge	enated hydro	carbons,			
Object	tives	preparation and p	roperties of	alcohols, ph	enols, eth	, ners and ep	oxides, sti	ructure react	ivity and			
-	preparation of carbonyl compounds, carboxylic acids and their derivatives.											
Course	• After completing this course, student is expected to learn the following:											
Outco	mes:	CO1: Understanding	g of chemistr	y of halogena	ated hydro	ocarbons	-					
		CO2: Understanding	g of preparati	ion and prop	erties of a	lcohols, phe	enols, ethe	rs and epoxid	les			
		CO3: Understanding	g of addition	reactions of	carbonyl o	compounds						
		CO4: Understanding	g the prepara	tion, physica	l properti	es and react	tions of ca	rboxylic acids				
	CO5: Understanding the preparation and reactions of Sulphur containing compounds											
		CO6: Scope of organ	nic reactions									
			C	OURSE SYLL	ABUS							
NOTE:												
i) Ques	stion no.	1 is compulsory and t	to be set from	the entire s	yllabus. It	will have se	ven sub-pa	arts and stude	nts need			
to answ	wer any f	our. Each part carrie	s three and h	alf marks.								
ii) Que	stion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every questi	on will hav	ve three sub-p	parts and			
studer	its need t	to answer any two su	ib-parts of ea	ch question.	Each part	carries sev	en marks.					
Unit				Conte	nts				Contact			
NO.									Hrs.			
1		IRY OF HALOGENAI	ED HYDROC/	ARBONS		ion vocatio			15			
	AIKYI IIC	icms with storoocho	preparation,	nucleophilic	substitut	ton reaction	ns — S _N I, ophilic cut	$S_N Z$ and $S_N N$				
	eliminat	ion	inical aspects		of solvern	l ell., hucie	opinite sur	Stitution vs.				
	Arvl ha	<i>lides:</i> Preparation i	including pre	paration fro	om diazou	nium salts	nucleophi	lic aromatic				
	substitu	tion; SNAr. Benzvne	mechanism.									
	Relative	reactivity of alkyl,	allyl/benzyl, v	vinyl and ary	/l halides	towards nu	Icleophilic	substitution				
	reactior	IS.					·					
	Organo	netallic compounds	of Mg and Li a	and their use	in synthe	esis.						
П	ALCOHO	OLS, PHENOLS, ETHE	RS AND EPOX	(IDES					15			
	Alcohols	s: preparation, prop	erties and re	elative react	ivity of 1	°, 2°, 3° alo	cohols, Bo	uvaelt-Blanc				
	Reducti	on; Preparation and	properties of	glycols: Oxid	ation by p	periodic acid	and lead t	etraacetate,				
	Pinacol-	Pinacolone rearrang	ement.									
	Phenols	: Preparation and pr	operties; Aci	dity and fact	ors effect	ing it, Ring	substitutio	on reactions,				
	Reimer-	-Tiemann and Kolk	pe's–Schmidt	Reactions,	Fries ar	nd Claisen	rearrange	ments with				
	mechan	ism.										
	Ethers a	nd Epoxides: Prepara	ation and rea	ctions with a	cids. Read	tions of epo	oxides with	alcohols,				
	ammon	ia derivatives and LiA	AIH4.									

Ш	CARBONYL COMPOUNDS	15
	Structure, reactivity and preparation; Nucleophilic additions, Nucleophilic addition-elimination	
	reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin	
	condensation, Knoevenagel condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction,	
	Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger	
	oxidation, α -substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, LiAlH ₄ ,	
	NaBH ₄ , MPV, PDC and PGC).	
	Addition reactions of unsaturated carbonyl compounds: Michael addition.	
	Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of	
	diethyl malonate and ethyl acetoacetate.	
IV	CARBOXYLIC ACIDS AND THEIR DERIVATIVES	15
	Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of	
	dicarboxylic acids, hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric,	
	citric, maleic and fumaric acids; Preparation and reactions of acid chlorides, anhydrides, esters and	
	amides; Comparative study of nucleophilic substitution at acyl group -Mechanism of acidic and	
	alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions,	
	Hofmannbromamide degradation and Curtius rearrangement.	
Sugge	sted Readings:	
1.	Solomons, T.W G., Fryhle, B. Craig. <i>Organic Chemistry,</i> John Wiley & Sons, Inc (2009).	
2.	McMurry, J.E. Fundamentals of Organic Chemistry, Seventh edition Cengage Learning (2013).	
3.	P. Sykes, A Guide Book to Mechanism in Organic Chemistry, Orient Longman, New Delhi, 6 th Editior	ו (1997) <i>,</i>
4.	4 Morrison R. T. and Boyd R. N. Organic Chemistry, Sixth Edition Prentice Hall India (2003).	

Course	e No:	Course Name:	Practical-II			Course Code: SBS CH 020204 C 0042				
Batch:		Programme:	Semester:	L	т	P	Credits	Contact Hrs		
2022		Integrated B.Sc		-	-	-		per Week:	04	
onwar	ds	M.Sc. Chemistry	П	0	0	4	2	Total Hrs.:	60	
Total E	Evaluatio	n Marks: 100	Examinatio	n Duration:		6 Hrs.				
CIE: 15 Marks		Pre-requisit	Pre-requisite of course: functional group tests, preparation of Organic							
TEE: 35 Marks		compounds	compounds							
Course Object	e tives	To provide student compounds	s with basic	with basic understanding of functional group tests, preparation of Organic						
CourseAfter completing this course, student is expected to learn the following:Outcomes:CO1: Understanding of Functional group tests for alcohols, phenols, carbor group.CO2: Understanding of preparation of inorganic compounds CO3: Learn organic chemistry through experiments					iyl and carbo	xylic acid				
	COURSE SYLLABUS									
NOTE:										
Two qu	uestions	will be set, one from	each of the L	JNIT. The car	ndidates a	re required	to attemp	t all the quest	ions.	
Unit No.		Contents							Contact Hrs.	
I	Identifi	cation of elements a	nd FUNCTION	IAL GROUP 1	TESTS				30	
	Identific	ation of elements (N, S, and hal	ogen) and fu	inctional	group tests	for alcoho	ols, phenols,		
11			group.						30	
	 II ORGANIC PREPARATIONS Acetylation of one of the following compounds: amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method:							30		

	х.	S-Benzylisothiouronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid). xi. Aldol condensation using either conventional or green method.	
	xii.	Benzil-Benzilic acid rearrangement.	
		The above derivatives should be prepared using 0.5-1g of the organic compound. The solid	
		samples must be collected and may be used for recrystallization, melting point and TLC.	
Sugge	sted	Readings:	
1.	M	ann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)	
2.	Fu (2)	rrniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pe 012)	earson
	`		

- 3. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
- 4. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

Semester III

Course	e No:	Course Name:		Course Code:						
		Physical Chemistry	/-	-		SBS CH 0	20301 C 3	104		
Batch:	:	Programme:	Semester:	L	Т	Р	Credit	Contact Hr	s.	
2022		Integrated B.Sc						per Week:	4	
onwar	ds	M.Sc.(Chemistry)	Ш	3	1	0	4	Total Hrs.:	60	
Total I	Evaluati	on Marks: 100	Examinatio	n Duration	:	3 Hrs.				
CIE:	30 Ma	rks	Pre-requisite of course: Knowledge of basic physical chemistry course up							
TEE:	70 Ma	rks	to Sen. Sec.	level.						
Course	2	To provide studen	ts with a ba	sic underst	anding of	chemical t	hermodyr	namics, and	chemical	
Object	tives	equilibrium. This	course will s	strengthen	the fundo	amentals o	of thermo	odynamics, e	specially	
_	chemical thermodynamics, and chemical equilibrium.									
Course	9	After completing t	his course, st	udent is ex	pected to	learn the f	ollowing:			
Outco	mes:	CO1: Basic underst	tanding of ch	emical the	rmodynam	nics.				
		CO2: Use of chemi	cal thermody	ynamics in	daily life.					
	CO3: Skills for analyzing and developing new sustainable methods.									
	CO4 : Skills for developing industrially important chemical methods.									
	CO5 : Development of alternate physical chemistry methods.									
		CO6: Use of advan	ced and rece	ent chemica	l thermod	ynamic ch	emistry.			
			CC	OURSE SYL	LABUS					
NOTE:										
i) Que	stion no	. 1 is compulsory ar	nd to be set f	rom the en	tire syllabı	us. It will h	ave sever	i sub-parts ai	nd	
studer	nts need	l to answer any four	. Each part c	arries three	e and half i	marks.				
ii) Que	estion n	os. 2 to 5 are to be	set from all	four units (one from e	each. Every	y questior	n will have th	ree sub-	
parts a	and stud	lents need to answe	er any two su	b-parts of	each quest	ion. Each l	part carrie	es seven mar	ks.	
Unit				Cont	ents				Contact	
No.									Hrs.	
I	CHEM	ICAL THERMODYNA	AMICS-I						15	
	Intens	ive and extensive	variables, st	ate and nat	h function	se isolate	d closed	and open		
	systen	is zeroth law of the	ermodynamic	ute and pa		15, 1501ato	u, cioscu	and open		
	First	law: Concept of he	eat. <i>a</i> . work.	w. interna	l energy. <i>l</i>	<i>U.</i> and stat	tement of	first law:		
	enthal	py, <i>H</i> , relation betw	een heat cap	acities, cal	culations o	f <i>q</i> , <i>w</i> , <i>U</i> a	nd <i>H</i> for r	eversible,		
	irrever	sible and free expa	unsion of gas	es (ideal ar	nd van der	· Waals) u	nder isoth	ermal and		
	adiaba	tic conditions.	C	,		,				
	Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the									
	second law of thermodynamics; molecular and statistical interpretation of entropy.									
	Calcul	ation of entropy ch	ange for reve	ersible and	irreversibl	e processe	es.			
	Third	Law: Statement of	f third law, c	oncept of a	residual en	tropy, cale	culation of	f absolute		
	entrop	y of molecules.								
II	SYSTE	MS OF VARIABLE CO	OMPOSITION	and CHEN	IICAL THE	RMODYNA	MICS-II		15	

	Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs- Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.	
	CHEMICAL THERMODYNAMICS-II <i>Thermochemistry:</i> Heats of reactions: standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. Adiabatic flame temperature, explosion temperature.	
	<i>Free Energy Functions:</i> Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.	
ш	CHEMICAL EQUILIBRIUM	15
	Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exoergic and endoergic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Free energy of mixing and spontaneity; thermodynamic derivation of relations between the various equilibrium constants K_p , K_c and K_x . Le Chatelier principle (quantitative treatment); equilibrium between ideal gases and a pure condensed phase.	
IV	SOLUTIONS AND COLLIGATIVE PROPERTIES	15
	Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Excess thermodynamic functions.	
	Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.	
Sugge	sted Readings:	
1. 2. 3. asl 4.	 A. Peter, and J. Paula, Physical Chemistry 10th Edition, <i>Oxford University Press</i> (2014). T. Engel, and P. Reid, Physical Chemistry 3rd Edition, <i>Prentice-Hall</i> (2012). M. J. Assael, A. R. H. Goodwin, M. Stamatoudis, W. A. Wakeham, and S. Will, Corr ked questions in thermodynamics. <i>CRC Press</i>, New York (2011). I. N. Levine, Physical Chemistry 6th Edition, <i>Tata Mc Graw Hill</i> (2010). 	nmonly
5. 6. 7. <i>Ltd</i>	 C. R. Metz, 2000 solved problems in chemistry, <i>Schaum Series</i> (2006). G. W. Castellan, Physical Chemistry 4th Edition, <i>Narosa</i> (2004). D. A. McQuarrie, and J.D. Simon, Molecular Thermodynamics, <i>Viva Books Pvt.</i> d., New Delhi (2004). 	

Course	e No:	Course Name: Physical Chemistry	/ Practical-II		Course Code: SBS CH 020302 C 0042				
Batch:		Programme:	Semester:	L	Т	Р	Credit	Contact Hrs	
2022		Integrated B.Sc						per Week:	04
onwar	ds	M.Sc. Chemistry	III	0	0	4	2	Total Hrs.:	60
Total E	Evaluati	on Marks: 50	Examinatio	Examination Duration: 6 Hrs.					
CIE:	15 Ma	rks	Pre-requisit	te of cou chemistry	rse: Know	vledge of laboratory	solution	preparation,	, safety owledge
TEE:	35 Ma	rks	up to Sen. S	ec. level.	1	,			
Course Object	e tives	To provide studer strengthen the fun techniques.	nts with a bo damentals o	asic unders fanalytical	standing o chemistry	f laborato , and basic	ry techniq s of physic	ues. This coι αl chemistry μ	urse will practical
Course After completing Outcomes: CO1: Basic unders CO2: Use of surfac CO3: Skills for ana CO4: Skills for dev CO5: Developmer CO6: Use of advar			his course, student is expected to learn the following: anding of physical chemistry practical. e tension, viscosity and indexing techniques in daily life. yzing and developing new sustainable methods. eloping industrially important practical methods. c of alternate testing methods. ced and recent techniques in experimental chemistry.						
			CC	OURSE SY	LLABUS				
NOTE: delete	Depen	ding on availabil	ity of time a	and equip	oment's, s	ome expe	eriments	may be add	.ed/
Unit No.				Cont	ents				Contact Hrs.
1	THERMOCHEMISTRY-I (a) Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization). (b) Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide. (c) Calculation of the enthalpy of ionization of ethanoic acid. (d) Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.								30
II	 THERMOCHEMISTRY-II (a) Determination of basicity/proticity of a polyprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperature versus time for different additions of a base. Also calculate the enthalpy of neutralization of the first step. (b) Determination of enthalpy of hydration of copper sulphate. (c) Study of the solubility of benzoic acid in water and determination of ΔH. 								30

Suggested Readings:

- 1. R. Gupta, Practical Physical Chemistry, New Age International Pub. House, New Delhi (2017).
- 2. J. B. Yadav, Advanced Practical Physical Chemistry, Krishana Prakashan Media, Pvt. Ltd. (2015).
- 3. B.D. Khosla, V. C. Garg, a n d A. Gulati, Senior Practical Physical Chemistry, *R. Chand & Co.*, New Delhi (2011).
- 4. V. D. Athawale, and P. Mathur, Experimental Physical Chemistry, *New Age International*, New Delhi (2001).
- 5. A. M. Halpern, and G. C. Mc. Bane, Experimental Physical Chemistry 3rd Edition, W.H. Freeman & Co., New York (2003).

Course	e No:	Course Name:			Course Code:						
		Organic Chemistry-				SBS CH ()20303 C 3	3104			
Batch	:	Programme:	Semester:	L	т	Р	Credits	Contact Hrs	5.		
2022		Integrated B.Sc						per Week:	04		
onwar	ds	M.Sc. Chemistry	111	3	1	0	4	Total Hrs.:	60		
Total I	Evaluatio	n Marks: 100	Examinatio	Examination Duration: 3 Hrs.							
CIE:	CIE: 30 Marks		Pre-requisite of course: Basic understanding of nitrogen containing functional groups, polynuclear hydrocarbons, heterocyclic compounds, alkaloids, terpenes								
TEE:	70 Mar	ks	0 1 /1 /	,		, ,	•		<i>,</i> ,		
Course	8	To provide students	with basic u	nderstanding	of nitrog	en containii	ng functior	al groups, pr	eparation		
Object	tives	of polynuclear hydr	ocarbons, inti	roduction of	heterocyc	lic compoui	nds, genero	al features of	alkaloids,		
		terpenes									
Course	е	After completing th	is course, stu	dent is expe	cted to le	arn the follo	owing:				
Outco	mes:	CO1: Nitrogen cont	aining functio	onal groups a	nd their r	eactions.					
	CO2: Familiarization with polynuclear hydrocarbons and their reactions.										
	CO3: Heterocyclic compounds and their reactions.										
		CO4: Alkaloids and	Terpenes								
		CO5: Understandin	g reactions ar	nd reaction m	nechanisr	n of nitroge	n containii	ng functional	groups.		
		CO6: Understandin	g the reactior	is and mecha	nisms of	diazonium	compound	s.			
			C	OURSE SYLL	ABUS						
NOTE:	:										
i)Ques	stion no.	1 is compulsory and	to be set fron	n the entire s	syllabus. I	t will have f	our sub-pa	arts and stude	ents need		
to ans	wer any t	wo. Each part carries	s three and ha	alf marks.							
ii) Que	estion no	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will ha	ve three sub-	parts and		
studer	nts need	to answer any two su	ub-parts of ea	ch question.	Each par	t carries thr	ee and hal	f marks.			
Unit				Conte	nts				Contact		
No.									Hrs.		
I	NITROG	EN CONTAINING FU	NCTIONAL G	ROUPS					15		
	Prepara	tion and important	reactions of	nitro and co	mpounds	s, nitriles ar	nd isonitril	es Amines:			
	Effect o	f substituent and sc	lvent on bas	icity; Prepara	ation and	properties	: Gabriel p	hthalimide			
	synthes	is, Carbylamine rea	action, Manı	nich reactio	n, Hoffn	nann's exh	austive m	ethylation,			
	Hofmar	n-elimination reaction	on; Distinctio	n between 1	°, 2° and	3° amines v	vith Hinsbe	erg reagent			
	and nitr	ous acid. Diazonium	Salts: Prepara	ation and the	ir synthe	tic applicati	ons.				
	DOLM		0.110						45		
	POLYNUCLEAR HYDROCARBONS Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.								15		
III	HETEROCYCLIC COMPOUNDS	15									
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	Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings										
	containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of:										
	Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis),										
	Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine, Structure elucidation of indole, Fischer										
	indole synthesis and Madelung synthesis), Structure elucidation of quinoline and isoquinoline,										
	Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner- Miller synthesis,										
	Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction,										
	Derivatives of furan: Furfural and furoic acid.										
IV	ALKALOIDS AND TERPENES	15									
	Natural occurrence, General structural features, Isolation and their physiological action										
	Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of										
	Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and										
	Reserpine.										
	Occurrence, classification, isoprene rule; Elucidation of stucture and synthesis of Citral, Neral and										
	α-terpineol.										
Sugge	sted Readings:										
1.	Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Educa	ition).									
2.	Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).										
3.	Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products)), Dorling									
	Kindersley (India) Pvt. Ltd. (Pearson Education).										
4.	Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Welly & Sons (1976	5).									
5.	Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc.										
6.	McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.										
7.	Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd. Pub.										
8.	Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.										
9.	Singh, J.; Ali, S.M. & Singh, J. Natural Product Chemistry, Prajati Parakashan (2010).										

Course	e No:	Course Name:				Course Code:										
		Organic Chemistry	Practical-III			SBS CH 0	20304 C 0	042								
Batch:		Programme:	Semester:	L	т	Р	Credits	Contact Hrs	•							
2022		Integrated B.Sc						per Week:	04							
onwar	ds	M.Sc. Chemistry	III	0	0	4	2	Total Hrs.:	60							
Total I	Evaluatio	n Marks: 100	Examinatio	n Duration:		6 Hrs.										
CIE:	15 Marl	ks	Pre-requisite of course: functional group tests, preparation of Organic compounds													
TEE:	35 Marl	۲S														
Course	2	To provide student	s with basic	understandir	ng of fun	ctional grou	ip tests, p	reparation of	f Organic							
Object	tives	compounds				-			-							
Course	9	After completing th	is course, stu	dent is exped	cted to lea	arn the follo	wing:									
Outco	utcomes: CO1: Understanding of Functional group tests for alcohols, phenols, carbonyl and carboxylic							xylic acid								
		group.														
		CO2: Understanding	g of preparati	ion of organio	c compou	nds										
		CO3: Learn organic	chemistry th	rough experii	ments											
	CO4: Preparation of methyl orange															
	CO5: Extraction of caffeine from tea leaves															
		CO6: Analysis of Ca	rbohydrate													
			C	OURSE SYLL	ABUS											
NOTE:																
i)Ques	tion no. 2	1 is compulsory and	to be set fron	n the entire s	syllabus. I	t will have f	our sub-pa	arts and stude	ents need							
to ans	wer any t	wo. Each part carries	s three and h	alf marks.												
ii) Que	estion nos	s. 2 to 5 are to be set	from all four units one from each. Every question will have three sub-parts and						parts and							
studer	nts need t	o answer any two su	b-parts of ea	ch question.	Each part	t carries thre	ee and half	f marks.								
Unit				Contei	nts				Contact							
No.									Hrs.							
I	1. Qual	itative analysis of	unknown or	ganic compo	ounds co	ntaining m	onofunctio	onal groups	60							
	(carboh	ydrates, aryl halides,	aromatic hy	drocarbons,	nitro com	npounds, an	nines and a	amides) and								
	simple b	oifunctional groups, f	or e.g. salicyl	ic acid, cinna	mic acid,	nitrophenol	s, etc.									
	2. Ident	ification of functiona	al groups of s	imple organi	c compou	unds by IR s	pectroscop	oy and NMR								
	spectros	scopy (IR and NMR	of simple or	ganic compo	unds may	y be done v	wherever	facilities are								
	availabl	e, otherwise sample	spectra may	be provided	for simple	e organic co	mpounds	like Ethanol,								
	Aniline, Phenol, acetic acid, other simple aldehydes, carboxylic acid, etc., for identification of															
	functional groups. References from standard spectroscopy books may also be taken for such															
	purpose	for enhancing stude	ents understa	nding and ski	II).											
	3. Prepa	ration of methyl ora	nge.													
4. Extraction of caffeine from tea leaves.																
	5. Analy	sis of Carbohydrate:	aldoses and	ketoses, redu	ucing and	non-reduci	ng sugars	using simple								
	lab proc	edures.						ab procedures.								

- 1. Vogel, A.I. *Quantitative Organic Analysis,* Part 3, Pearson (2012).
- 2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
- 3. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.,* Pearson (2012)
- 4. Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis,* University Press (2000).
- 5. Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: Qualitative Analysis,* University Press (2000).

Course	e No:	Course Name: Molecular Spectros	copy & Photo	chemistry		Course Co SBS CH (ode: 020305 C 3	104			
Batch:	:	Programme:	Semester:	L	Т	Р	Credits	Contact Hrs	•		
2022		Integrated B.Sc						per Week:	04		
onwar	ds	M.Sc. Chemistry	Ш	3	1	0	4	Total Hrs.:	60		
Total I	Evaluatio	n Marks: 100	Examinatio	n Duration:	1	3 Hrs.	1	I			
CIE:	30 Mar	٢S	Pre-requisit	Pre-requisite of course: Knowledge of radiation and its interaction with							
TEE:	70 Marl	<s< td=""><td>matter. Kno</td><td>wiedge of ro</td><td>tation, vii</td><td>oration in m</td><td>lolecules.</td><td></td><td></td></s<>	matter. Kno	wiedge of ro	tation, vii	oration in m	lolecules.				
Course	8	To provide students	with basic un	derstanding	of variou	s spectrosco	opic technio	ques such as r	otational		
Object	tives	spectroscopy, FTIR	spectroscopy	, Raman spe	ctroscop	y and electr	onic spect	roscopy. The	students		
		will be also equippe	ed with under	standing of p	photophy	sical and ph	otochemic	al processes.			
Course	e	After completing th	iis course, stu	dent is expe	cted to le	arn the follo	owing:				
Outco	mes:	CO1: Understandin	g of basic prir	nciples of spe	ctroscop	y					
	CO2: Understanding of concept of rotational spectroscopy										
		CO3: Knowledge of	vibrational sp	pectroscopy,	both FTIF	R and Rama	n				
		CO4: Understandin	g principles o	f electronic s	pectrosco	ру					
	CO5: Understanding the concept of photophysical phenomena										
	CO5: Understanding of photochemistry										
	COURSE SYLLABUS										
NOTE: i) Ques need t ii) Que	 NOTE: i) Question no. 1 is compulsory and to be set from the entire syllabus. It will have seven sub-parts and students need to answer any four. Each part carries three and half marks. ii) Question nos. 2 to 5 are to be set from all four units one from each. Every question will have three sub-parts and 										
studer	nts need t	o answer any two su	ub-parts of ea	ch question.	Each par	t carries sev	en marks.				
Unit No				Conte	nts				Contact		
140.	GENER		ΟΤΔΤΙΟΝΔΙ	SPECTROSCO)PY				15		
•	Interact	ion of electromagn	etic radiation	with molec	cules and	various tv	nes of spe	ectra: Born-	15		
	Oppenh determi	eimer approximation nation of bond lengt	n. Rotation sp hs of diatomi	ectroscopy: c and linear t	Selection triatomic	rules, inter molecules,	isotopic su	bectral lines, bstitution.			
11	VIBRAT	IONAL SPECTROSCO	РҮ						15		
	Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.										
III	RAMAN Raman	AND ELECTRONIC S	PECTROSCOP	Υ ent of Rotat	ional Ran	nan effect:	Effect of n	uclear spin	15		
	Vibratio	nal Raman spectra, S n.	Stokes and an	ti-Stokes line	es; their i	ntensity diff	ference, ru	le of mutual			
	Electror states, f	ic spectroscopy: Fra luorescence and phc	nck-Condon p psphorescence	orinciple, elec e, dissociatio	ctronic tra n and pre	ansitions, sinedissociation	nglet and t	riplet			

IV	PHOTOPHYSICAL AND PHOTOCHEMICAL PROCESSES Laws of photochemistry, quantum yield. Jablonski diagrams: Franck-Condon principle, Law of photochemical equivalence, quantum efficiency, low and high quantum efficiency. Kinetics of photochemical reactions $(H_2 + B_2 = HBr, 2HI = H_2 + I_2)$, energy transfer in photochemical reactions	15
	(photosensitization and quenching), fluorescence, phosphorescence, chemiluminescence, Discussion of Electronic spectra and photochemistry (Lambert-Beer law and its applications).	
Sugge	sted Readings:	
1.	Laideler K. J. and Meiser J. M. Physical Chemistry Third Edition, International (1999).	
2.	Levine I. N., Physical Chemistry, Fourth Edition), McGraw-Hill, International (1995).	
3.	McQuarrie D. A. and Simon J. D. <i>Physical Chemistry- A Molecular Approach</i> , University Scien (1998).	ce Books
4.	Rohatgi-Mukherjee K. K. Fundamentals of Photochemistry, New age, revised second edition (2017).
5.	Banwell, C. N. & McCash, E. M. <i>Fundamentals of Molecular Spectroscopy</i> 4th Ed. Tata McGraw-Delhi, (2006).	Hill: New

Course	e No:	Course Name: Spectroscopy Pract	ical			Course Co SBS CH (ode: 020306 C (0042	
Batch	:	Programme:	Semester:	L	Т	Р	Credits	Contact Hrs.	
2022		Integrated B.Sc						per Week:	04
onwar	ďs	M.Sc. Chemistry	111	0	0	4	2	Total Hrs.:	60
Total I	Evaluatio	n Marks: 50	Examinatio	n Duration:		6 Hrs.			
CIE:	15 Mar	ks	Pre-requisit	e of course:	Knowled	ge of indica	tors, colori	metry, Lambei	rt-Beers
TEE:	35 Marl	۲S	law						
Course	e	To skill students ab	out determin	ation of indic	ator cons	stant of vari	ious indicat	tors by colorim	netry and
Object	tives	verify Beer's law fo	r determining	concentratio	on of a gi	ven solutior	n by colorin	netry.	
Course	е	After completing th	iis course, stu	dent is expe	cted to le	arn the foll	owing:		
Outco	mes:	CO1: Practical unde	erstanding of	Colorimetry					
	CO2: Knowledge of indicator constant								
	CO3: Practical understanding of Beer's law								
	CO4: Understanding of the determination of concentration of solutions								
		CO5: Develop skill o	of using a Colo	orimeter					
		CO6: Understandin	g of adsorptio	n					
			C	OURSE SYLL	ABUS				
NOTE: Two q	uestions	will be set, one from	each of the l	JNIT. The car	ididates a	are required	l to attemp	ot all the quest	ions.
Unit				Conte	nts				Contact
No.									Hrs.
I	COLORI	METRY							30
	Determi	nation of indicator of	onstant - colo	rimetrv					
II	VERIFIC	ATION OF BEER'S LA	W	i i i i i i i i i i i i i i i i i i i					30
	Verifica	tion of Beer's Law - D	Determinatior	n of concentr	ation of s	solution by	colorimetry	<i>v</i> .	
	(Instruc	tor may explain th	e principle o	of using cold	orimeter	its handli	ng drawin	, g standard	
	calibrat	on curve, and its app	olication in fir	iding unknow	/n concer	ntration of o	dves. conce	entration of	
	metal so	olutions (<i>e.g</i> .Ni, Cu u	sing appropri	ate reagent)	from stai	ndard calibr	ation curve	e.	
Sugge	sted Rea	dings:							
	1. Pract	icals in physical cher	nistry – a mo	dern approad	h, P.S.Sir	ndhu, Macm	nillan (2009	9).	
	2. Expe	riments in Physical C	hemistry, J.M	.Wilson, R.J.I	Newcoml	o, A.R.Dena	ro, 2 nd Edn	., Elsevier (196	58).

Semester IV

Course	e No: Course Name: Course Code:								
		Physical Chemistry-	-111			SBS CH 0	20401 C 3	104	
Batch:		Programme:	Semester:	L	т	Р	Credits	Contact Hrs	•
2022		Integrated B.Sc						per Week:	04
onwar	ds	M.Sc. Chemistry	IV	3	1	0	4	Total Hrs.:	60
Total I	Evaluatio	n Marks: 100	Examinatio	n Duration:		3 Hrs.			
CIE:	30 Mar	۲S	Pre-requisit	e of course	: Concep	ot of phase	s, compo	nents and d	egrees of
			freedom, Or	der and mole	ecularity o	of a reactior	n, Types of	catalyst, spec	ificity and
TEE:	70 Marl	<s< td=""><td>selectivity, F</td><td>Physical adso</td><td>rption, ch</td><td>emisorption</td><td>า.</td><td></td><td></td></s<>	selectivity, F	Physical adso	rption, ch	emisorption	า.		
Course	2	Concept of phases,	components d	and degrees o	of freedon	n, Order and	' molecular	rity of a reacti	on, Types
Object	tives	of catalyst, specifici	ity and select	ivity, Physical	adsorpti	on, chemiso	rption.		
Course	9	After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:		
Outco	mes:	CO1: Phases, comp	onents, Gibbs	s phase rule,	Phase dia	grams and a	application	IS.	
		CO2: Chemical kine	etics: type of	reactions, de	terminati	on of rate,	theories o	f reaction rat	e, steady
		state approximation	n.						
		CO3: Catalyst – me	chanism, acid	base catalys	is, enzym	e catalysis.			
		CO4: Adsorption iso	otherms.						
	CO5: Understanding phases, components, Gibb's phase rule and its applications, construction								
		phase diagram of d	ifferent syste	ms, the appli	cation of	phase diagr	am.		
		CO6: Understandin	g the basics o	f chemical ki	netics.				
			C	OURSE SYLL	ABUS				
NOTE:									
i)Ques	tion no.	1 is compulsory and	to be set fron	n the entire s	syllabus. I	t will have f	our sub-pa	arts and stude	ents need
to ans	wer any t	wo. Each part carries	s three and h	alf marks.					
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will hav	ve three sub-	parts and
studer	nts need t	o answer any two su	b-parts of ea	ch question.	Each part	carries thre	ee and half	f marks.	
Unit				Conte	nts				Contact
No.									Hrs.
I	PHASE I	QUILIBRIA							15
	Concept	of phases, compor	nents and de	grees of free	edom, de	rivation of	Gibbs Pha	ise Rule for	
	nonread	tive and reactive sys	tems; Clausiu	s-Clapeyron	equation	and its appl	ications to	solid-liquid,	
	liquid-va	apour and solid-vap	our equilibri	a, phase dia	agram fo	r one com	ponent sys	stems, with	
	applications. Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent								
	and inc	ongruent melting po	oints, solid so	lutions. Thre	e compo	nent syster	ns, water-	chloroform-	
	acetic a	acid system, triangu	ular plots. B	inary solutic	ons: Gibb	s-Duhem-N	largules e	quation, its	
	derivati	on and applications t	o fractional d	istillation of	binary mi	scible liquid	s (ideal an	d nonideal),	
	azeotro	pes, lever rule, parti	al miscibility	of liquids, CS	T, miscibl	le pairs, ste	am distilla	tion. Nernst	
	distribu	tion law: its derivatio	on and application	ations.					

			15
		Cricivical Niverico	12
		Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction,	
		differential and integrated rate laws for first, second and fractional order reactions,	
		pseudounimolecular reactions, determination of the order, kinetics of complex reactions (limited	
		to first order): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their	
		differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain	
		reactions. Temperature dependence of reaction rates; Arrhenius equation; activation energy.	
		Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of	
		absolute reaction rates.	
III		CATALYSIS	15
		Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces;	
		effect of particle size and efficiency of nanoparticles as catalysts. Enzyme catalysis, Michaelis-	
		Menten mechanism, acid-base catalysis.	
IV		SURFACE CHEMISTRY	15
		Physical adsorption, chemisorption, adsorption isotherms (Freundlich, Temkin, Derivation of	
		adsorption (no derivation) Adsorption in solution	
Sug	ges	sted Readings:	
	1.	Atkins P. W. and De Paula J., Physical Chemistry, (tenth edition) Oxford University Press, 2014.	
	2.	Castellan, G. W. Physical Chemistry, 4th Ed., Narosa, 2004.	
	3.	McQuarrie, D. A. & Simon, J. D., Molecular Thermodynamics, Viva Books, 2004.	
	4.	Engel, T. & Reid, P. Physical Chemistry Third Edition, Prentice-Hall, 2012.	
	5.	Zundhal, S.S. Chemistry concepts and applications Cengage India, 2011	
	6.	Ball, D. W. Physical Chemistry Cengage India, 2012.	
	7.	Mortimer, R. G. Physical Chemistry 3rd Ed., Elsevier: NOIDA, UP, 2009.	
	8.	Levine, I. N. Physical Chemistry 6th Ed., Tata McGraw-Hill, 2011.	
	9.	Metz, C. R. Physical Chemistry 2nd Ed., Tata McGraw-Hill, 2009.	
L			

Course	e No:	Course Name: Course Code:							
		Physical Chemistry-	III Practical			SBS CH 0	20402 C 0	042	
Batch	:	Programme:	Semester:	L	Т	Р	Credits	Contact Hrs	•
2022		Integrated B.Sc						per Week:	04
onwar	ds	M.Sc. Chemistry	IV	0	0	4	2	Total Hrs.:	60
Total I	Evaluatio	n Marks: 100	Examination Duration: 6 Hrs.						
CIE:	CIE: 15 Marks		Pre-requisite of course: Determination of cell constant, Potentiometric titrations Determination of cell constant, Potentiometric titrations						
TEE:	35 Mar	ks							
Course	2	Determination of a	cell constant,	Potentiome	tric titrat	ions			
Object	tives								
Course	e	After completing th	nis course, stu	dent is expe	cted to lea	arn the follo	wing:		
Outco	mes:	CO1: Determination	n of cell const	ant					
		CO2: Equivalent co	nductance, de	egree of disso	ociation a	nd dissociat	ion consta	nt of a weak	acid.
		CO3: Potentiometr	ric titrations						
	CO4: Conductometric titrations of Strong acid Vs. strong base								
		CO5: Conductomet	ric titrations of	of Strong acid	d vs. weak	base.			
		CO6: Potassium dic	hromate vs. I	Mohr's salt					
			C	OURSE SYLL	ABUS				
NOTE:	1								
i)Ques	stion no.	1 is compulsory and	to be set fror	n the entire s	syllabus. I	t will have f	our sub-pa	arts and stude	ents need
to ans	wer any t	wo. Each part carrie	s three and h	alf marks.					
ii) Que	estion no	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will ha	ve three sub-	parts and
studer	nts need	to answer any two su	ub-parts of ea	ch question.	Each part	t carries thre	ee and half	f marks.	
Unit				Conte	nts				Contact
No.									Hrs.
I	Conduc	tometry							30
	1 Deter	mination of cell cons	tant						
	2 Equiva	alent conductance, d	egree of disso	ociation and	dissociatio	on constant	of a weak	acid.	
	3.Conductometric titrations of: Strong acid Vs. strong base (ii) Weak acid vs. strong ba					g base, (iii)			
	Mixture	of strong acid and (i	v)weak acid v	vs. strong bas	e, Strong	acid vs. wea	ak base.		
II	Potenti	ometry							30
	Potenti	ometric titrations of	: (i) Strong a	cid vs. stron	g base (ii) Weak acio	d vs. stron	g base (iii)	
	Dibasic	acid vs. strong base ((iv) Potassium	n dichromate	vs. Mohr	's salt.			

1 Khosla, B. D.; Garg, V. C. and Gulati, A. Senior Practical Physical Chemistry, R. Chand New Delhi, 2011. 2 Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry Eighth Edition; McGraw-Hill: New York, 2003.

3 Halpern, A. M. and McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York, 2003.

(List of experiments and references are suggestive. However, more experiments can be added/list of experiments can be revised as per available facilities).

Course	e No:	Course Name:	v-11			Course Co	de: 20403 C 3	104			
Batch:	:	Programme:	Semester:	L	т	P	Credits	Contact Hrs	•		
2022		Integrated B.Sc						per Week:	04		
Onwai	rds	M.Sc. Chemistry	IV	3	1	0	4	Total Hrs.:	60		
Total I	Evaluatio	n Marks: 100	Examinatio	Examination Duration: 3 Hrs.							
CIE:	30 Mar	ks	Pre-requisit	e of course:	Idea of m	etallurgy, H	SAB princi	ple, chemistry	y of s and		
TEE:	70 Marl	ks	p BIOCK Elements, inorganic polymers, occurrence and uses of noble gases.								
Course	2	To provide student	ts with basic	understandi	<i>ng of</i> Pri	nciples of r	netallurgy,	concept of a	acid-base		
Object	tives	reactions, Chemisti compounds.	ry of s and p	Block Eleme	ents, occu	irrence and	nature of	bonding in r	oble gas		
Course	е	After completing th	iis course, stu	dent is expe	cted to lea	arn the follo	wing:				
Outco	mes:	CO1: Understandin	g of principle	s of metallur	gy						
	CO2: Understanding the concept of acid-base reactions										
	CO3: Understanding the basic properties of elements of s and p Block										
		CO4: Understandin	g the Types o	f inorganic n	e or boriu olymers		gas comp	ounus			
		CO6: Scope of inorg	g the types of ganic compou	nds/polymei	s						
			<u> </u>	OURSE SYLL	ABUS						
NOTE:	:										
i) Que	stion no.	1 is compulsory and	to be set fror	n the entire s	syllabus. I	t will have s	even sub-j	parts and stud	dents		
need t	o answei	any four. Each part	carries three	and half mar	ks.						
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will ha	ve three sub-	parts and		
studer	nts need t	to answer any two su	ub-parts of ea	ch question.	Each part	t carries sev	en marks.		[
Unit				Conte	nts				Contact		
NO.	CENED		TALLIDOV						Hrs.		
1	GENERA Chief m	ades of occurrence of	TALLUKGY	nd on standa	rd alactro	do notontia	le Ellingha	m diagrams	15		
	for redu	iction of metal oxide	s using carbo	on and carbo	n monoxi	de as reduc	ing agent.	Flectrolytic			
	Reducti	on, Hydrometallurgy	. Methods of	purification	of metals	: Electrolyti	c Kroll prod	cess, Parting			
	process, van Arkel-de Boer process and Mond's process, Zone refining.										
II	CHEMIS	TRY OF s AND p BLO	CK ELEMENT	S		-			15		
	Inert pa	air effect, Relative	stability of o	different oxi	dation st	ates, diago	nal relatic	onship and			
	anomal	ous behaviour of fi	rst member	of each gro	oup. Allo	tropy and	catenation	. Complex			
	formati	on tendency of s and	p block elem	ents.							

	Hydrides and their classification. Boric acid and borates, boron nitrides, borohydrides (diborane)	
	carboranes and graphitic compounds, silanes, Oxides and oxoacids of hitrogen, Phosphorus and	
	chlorine. Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and	
	basic properties of halogens.	
	Synthesis, structural aspects and applications of silicones and siloxanes, borazines, silicates and	
	phosphazenes, and polysulphates.	
III	NOBLE GASES	15
	Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation and	
	properties of XeF ₂ . XeF ₄ and XeF ₆ : Nature of bonding in noble gas compounds (Valence bond	
	treatment and MO treatment for XeE_2). Molecular shapes of noble gas compounds (VSEPR	
	theory)	
11/		1 Г
IV	INORGANIC POLYMERS	15
	Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and	
	applications of silicones and siloxanes. Borazines, silicates and phosphazenes, and polysulphates.	
Sugge	sted Readings:	
1.	Lee, J.D. Concise Inorganic Chemistry, ELBS (1991).	
2.	Douglas, B.E; Mc Daniel, D.H. & Alexander, J.J. Concepts & Models of Inorganic Ch	emistry
	3 rd Ed., John Wiley Sons, N.Y. (1994).	
3.	Greenwood, N.N. & Earnshaw. Chemistry of the Elements, Butterworth- Heinemann (1997).	
4.	Cotton, F.A. & Wilkinson, G. Advanced Inorganic Chemistry, Wiley, VCH (1999).	
5.	Rodger, G.E. Inorganic and Solid-State Chemistry, Cengage Learning India Edition (20	002).
6	Miessler, G. L. & Donald, A. Tarr. <i>Inorganic Chemistry</i> 4 th Ed., Pearson (2010)	
7	Atkins P Shriver & Atkins' Inorganic Chemistry 5 th Ed. Oxford University Press (2010)	
1 /.	Tradito, T. Shirver e Thanks morganic chemistry 5 Ed. Onlota Chrydistry 11055 (2010).	

Course	e No:	Course Name: Inorganic Chemistry	/ Practical-II			Course Co SBS CH 0	de: 20404 C 0	042	
Batch	:	Programme:	Semester:	L	т	Р	Credits	Contact Hrs	•
2022		Integrated B.Sc						per Week:	04
Onwa	rds	M.Sc. Chemistry	IV	0	0	4	2	Total Hrs.:	60
Total	Evaluatio	n Marks: 100	Examinatio	n Duration:		6 Hrs.		·	
CIE:	15 Mar	ks	Pre-requisit	e of course:	lodo / ioc	limetric titra	ations, inoi	rganic prepara	ations
TEE:	35 Mar	ks							
Course Objec	e tives	<i>To provide students</i> compounds	with basic un	derstanding	of Iodo / i	iodimetric ti	trations, p	reparation of	inorganic
Course Outco	Outcomes: CO1: Understanding of Estimation of ions by Iodimetrically / iodometrically CO2: Understanding of Preparation of inorganic compounds CO3: Learn Inorganic chemistry through experiments								
			C	OURSE SYLL	ABUS				
NOTE	:								
Two q	uestions	will be set, one from	each of the L	JNIT. The car	ididates a	re required	to attemp	t all the quest	tions.
Unit				Conte	nts				Contact
10.		IODIMETRIC TITRAT							пг з. 30
	(i) Es	timation of Cu(II) and	d K ₂ Cr ₂ O ₇ usi	ing sodium t	thiosulph	ate solutior	n (lodimetr	rically).	50
	(ii) Es	timation of (i) arseni	te and (ii) ant	imony in tart	ar-emeti	c iodimetric	ally		
	(iii) Es	timation of available	e chlorine in b	leaching pov	vder iodo	metrically.			
11	INORGA (i) Cupr	NIC PREPARATIONS ous Chloride, Cu ₂ Cl ₂	i						30
	(ii) Pre alum.	paration of Aluminit	ım potassium	n sulphate KA	AI(SO4)2.1	2H ₂ O (Pota	ash alum)	or Chrome	
Sugge 1. Me	sted Rea ndham, J.	dings: , A. I. Vogel's Quanti	tative Chemic	al Analysis 6	th Ed., Pe	arson (2009)).		

Course No:	Course Name:	antum Chomi	stru		Course Co	de:	104		
Patch	Brogramme	Somostor:		-		Cradita	Contact Ura		
2022	Programme:	Semester.	L		P	creats		. 04	
2022 opwards	M Sc. Chomistry	11/	2	1	0	4		60	
	on Marks: 100		5	L T	0	4		00	
TULAI EVAIUALI		Examinatio	n Duration:		3 Hrs.				
CIE: 30 Ma	rks	Pre-requisit	e of cours	se: Intro	duction to	black-b	ody radiatio	on and	
		distribution of energy, Basic idea about operators, eigen function and							
TEE: 70 Ma	rks	values, schrödinger equation and application to free-particle and particle							
		distances of electron from nucleus							
Course	Introduction to bl	ustances of electron non-nucleus.							
Obiectives	eigen function and	l values. Schr	odinaer eau	ation and	l annlicatio	n to free-n	article and n	article in	
	a hox, discussion o	of solution of	wave functio	ons. Avera	ae and mo	st nrohahle	e distances of	f electron	
	from nucleus.								
Course	After completing th	nis course, stu	dent is expe	cted to lea	arn the follo	wing:			
Outcomes:	CO1: Introduction	to black-bod	v radiation a	nd distril	oution of er	nergy			
	CO2 : Quantitative treatment of simple harmonic osciallator model								
	CO3: Qualitative treatment of hydrogen atom and hydrogen-like ions								
	CO4: Scope of Phys	ical Chemistr	v		/				
	CO5: Representation	ons of hydroge	, enic orbitals						
	CO6: Valence bond	and molecula	ar orbital app	oroaches					
	1	C	OURSE SYLL	ABUS					
NOTE:									
i)Question no	1 is compulsory and	to be set fron	n the entire s	syllabus. I	t will have f	our sub-pa	arts and stude	ents need	
to answer any	two. Each part carrie	s three and h	alf marks.						
ii) Question no	os. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will hav	ve three sub-	parts and	
students need	to answer any two su	ub-parts of ea	ch question.	Each par	t carries thr	ee and half	f marks.		
Unit			Conte	nts				Contact	
No.								Hrs.	
I UNIT-I								20	
Introd	uction to black-body	radiation and	distribution	of energy	, photo-ele	ctic effect,	concept of		
quanti	zation, wave particle of	uality (de-Br	oglie's hypot	hesis), Th	e uncertaint	ty principle	, The wave		
functio	n: wave function and	its interpreta	tion, conditio	ons of nor	malization a	nd Orthog	onality and		
its sign	ifficance. Basic idea at	out operator	s, eigen func	tion and v	values, Schr	oainger eq	uation and		
applica	application to free-particle and particle in a box, boundary condition					wave tun	coons and		
energi	r parts of the budrog	ogen atom, schrödinger equation in polar coordinates, radial and							
hydros	enic orbitals.	enic orbitals, degeneracies, spherical harmonics, representations of							
II UNIT-I	· 							20	
Quant	tative treatment of si	mple harmon	ic osciallator	[.] model, s	etting up of	Schodinge	er equation		
and dis	cussion of solution of	wave functio	ons. Rigid rota	ator mode	el and discu	ssion of ap	plication of		

	Schrodinger equation. idea about transformation to spherical polar coordinate, discussion on							
	solution,							
III	UNIT-III	20						
	Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger							
	equation in spherical polar coordinates, radial part, quantization of energy (only final energy							
	expression). Average and most probable distances of electron from nucleus. Valence bond and							
	molecular orbital approaches, LCAO-MO treatment of H2, H2+; bonding and anti-bonding							
	orbitals, Comparison of LCAO-MO and VB treatments of H2 (only wavefunctions, detailed solution							
	not required) and their limitations.							
Sug	gested Readings:							
	1. Laideler K. J. and Meiser J. M. Physical Chemistry Third Edition (International)1999							
	2. Levine I. N., Physical Chemistry, Fourth Edition), McGraw-Hill (International), 1995.							
	3. McQuarrie D. A. and Simon J. D. Physical Chemistry- A Molecular Approach, University Science							
	Books, 1998.							
	4.Chandra, A. K. Introductory Quantum Chemistry Tata McGraw-Hill (2001).							
	5. House, J. E. Fundamentals of Quantum Chemistry 2nd Ed. Elsevier: USA (2004).							

Course	No:	Course Name: Course Code:								
		Quantum Chemistr	y Practical			SBS CH 0	20406 C 0	042		
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact Hrs.		
2022		Integrated B.Sc						per Week:	04	
onward	ds	M.Sc. Chemistry	IV	0	0	4	2	Total Hrs.:	60	
Total E	valuatio	n Marks: 100	Examinatio	n Duration:		6 Hrs.				
CIE:	15 Mar	ks	Pre-requisit	Pre-requisite of course: calculate the energy of various conformations of						
		molecules,	students g	ain han	d-on expe	rience in	using ope	n-source		
TEE:	35 Marl	٢S	softwares, a	academic vis	it to com	putational	labs to gai	n knowledge	•	
Course		Calculate the energ	y of various o	conformation	s of mole	cules, stude	ents gain h	and-on expe	rience in	
Objecti	ives	using open-source	softwares, a	cademic visi	t to comp	utational la	abs to gair	n knowledge.		
Course		After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:			
Outcon	nes:	CO1: Building a mo	lecular model							
		CO2: Instructor car	n demonstrat	e the studer	nts use of	hyperchem	n software	, Gaussian so	ftware –	
		geometry optimizat	tion).							
		CO3: Basic idea is t	o encourage 、	the students	to get kn	owledge wi	thout keep	oing any rigid	practical	
		syllabus framework	.).							
			C	OURSE SYLL	ABUS					
NOTE:										
i)Quest	tion no.	1 is compulsory and	to be set fron	n the entire s	syllabus. I	t will have f	our sub-pa	irts and stude	nts need	
to answ	ver any t	wo. Each part carries	s three and ha	alf marks.						
ii) Ques	stion nos	s. 2 to 5 are to be set	from all four	units one fro	om each. I	Every quest	ion will hav	ve three sub-p	parts and	
studen	ts need t	o answer any two su	b-parts of ea	ch question.	Each part	carries thre	ee and half	marks.		
Unit				Conte	nts				Contact	
No.									Hrs.	
1	UNIT-I	students may be de	monstrated h	voorshom la	h activiti	ac huildin	a a malaci	ular model	30	
	(I) THE :	of atoms editing in	dividual atom	s changing h	ond orde	es – bullulli er centrerin	g a moleci	of atoms)		
	Selectio	n of calculation meth	nod (<i>e.a.</i> force	field calculat	tion, ab-ir	itio set un).	displaving	calculated		
	propert	ies. (instructor may d	emonstrate (Computer pro	ograms th	at calculate	the energy	of various		
	conform	nations of molecules	and predict	the lowest e	nergy, to	learn how	to constru	ct or draw		
	represe	ntations of molecu	iles using a	molecular	modelin	g program	called H	lyperChem		
	(HyperCube, Inc.), to perform geometry optimizations (energy minimizations) to determine the									
	lowest energy conformations of molecules).									
	(Depend	ding upon the avail	ability of inf	rastructure	facilities,	instructor	can demo	nstrate the		
	student	s use of hyperchem	software, Ga	ussian softwa	are – geo	metry optir	nization). 🗅	They can be		
	allowed	for academic visit	to computa	tional labs t	o gain k	nowledge a	and a repo	ort may be		
	conside	red for viva voce/exa	mination). Op	oen source so	oftwares n	nay be used	for lab der	nonstration		
	and stu	dents may prepare a	report alon	g with viva-v	oce shall	constitute	practical e	xamination.		
	Instruct	or may encourage th	e students to	gain hand-or	n experien	ce in using o	open-sourc	e softwares		

		(for perfoming various calculation as mentioned) in lab computers, periodic evaluation of which							
		can also be accepted as conducting lab practical examination. Basic idea is to encourage the							
		students to get knowledge without keeping any rigid practical syllabus framework).							
		(Examples of the computational work that can be done: Compare the optimized C-C bond lengths							
		in ethane, ethene, ethyne and benzene. Visualize the molecular orbitals of the ethane σ bonds and							
		ethene, ethyne, benzene and pyridine π bonds.							
-	II	UNIT-II	30						
		ii. (a) Perform a conformational analysis of butane. (b) Determine the enthalpy of isomerization of							
		<i>cis</i> and <i>trans</i> 2-butene.							
		iii. Visualize the electron density and electrostatic potential maps for LiH, HF, N_2 , NO and CO and							
		comment. Relate to the dipole moments. Animate the vibrations of these molecules.							
		(Software: ChemSketch, ArgusLab (www.planaria-software.com), TINKER 6.2							
		(dasher.wustl.edu/ffe), WebLab Viewer, Hyperchem, or any similar software.							
-	Sugge	sted Readings:							
	1.	Essentials of computational chemistry – Theories and models, C. J. Crammer, Wiley, 2nd Edn.,							
	2.	Principle and applications of quantum chemistry, V.K.Gupta, Elsevier, 2016.							
	3.	Practicals in physical chemistry – a modern approach, P.S.Sindhu, Macmillan,							
	4.	Experiments in Physical Chemistry, J.M.Wilson, R.J.Newcomb, A.R.Denaro, 2nd Edn., Elsevier.							
	5.	A.R. Leach, Molecular Modelling Principles and Application, Longman, 2001.							
	6.	J.M. Haile, <i>Molecular Dynamics Simulation Elementary Methods</i> , John Wiley and Sons, 1997.							
	7	Gunta S.P. OSAR and Molecular Modeling. Springer - Anamava Publishers, 2008							
1	/.	Supra, su i do in ana morecular modeling, opiniber i manayar abionero, 2000.							

Semester V

Course	e No:	Course Name:	Course Code:							
		Inorganic Chemistr	y-III			SBS CH 0	20501 C 3	3104		
Batch:	:	Programme:	Semester:	L	Т	Р	Credits	Contact Hrs	5.	
2022		Integrated B.Sc						per Week:	04	
onwar	ds	M.Sc.(Chemistry)	V	3	1	0	4	Total Hrs.:	60	
Total I	Evaluatio	n Marks: 100	Examinatio	n Duration:		3 Hrs.				
CIE:	30 Mar	ks	Pre-requisite of course: Basic understanding of coordination chemistry, transition elements, lanthanoids and actinoids, bioinorganic chemistry							
TEE:	70 Mar	<s< td=""><td>,</td><td></td><td></td><td></td><td></td><th></th><td></td></s<>	,							
Course	2	To provide studen	ts with basic	understandi	ng of co	ordination d	chemistry,	general prop	perties of	
Object	tives	transition elements	transition ele	ements, lanth	nanoids ai	nd actinoids	, bioinorgo	anic chemistry	/	
Course Outco	ourse After completing this course, student is expected to learn the following: utcomes: CO1: Coordination compounds – its nomenclature, theories, d-orbital splitting in complexes, chelate.							mplexes,		
		CO2: Transition me	tals, its stabili	ity, color, oxi	dation sta	ates and cor	nplexes.			
		CO3: Lanthanides,	Actinides – se	paration, col	or, spectr	a and magn	etic behav	/ior		
		CO4: Bioinorganic o	chemistry – m	etal ions in b	biological	system, its t	oxicity; he	moglobin.		
		CO5: Understandin	g the nomen	clature of co	ordinatio	n compoun	ds/comple	exes, Molecul	ar orbital	
		theory, d-orbital sp	litting in tetra	ihedral, octa	hedral, sq	luare planar	complexe	es, chelate eff	ects.	
		CO6: Understandir	ng the transit	ion metals s	stability i	n reactions,	, origin of	colour and	magnetic	
		properties.								
			C	OURSE SYLL	ABUS					
NOTE:										
i)Ques	stion no.	1 is compulsory and	to be set fron	n the entire s	syllabus. I	t will have f	our sub-pa	arts and stude	ents need	
to ans	wer any t	wo. Each part carrie	s three and ha	alf marks.						
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will ha	ve three sub-	parts and	
studer	nts need t	to answer any two su	ub-parts of ea	ch question.	Each part	t carries thre	ee and half	f marks.	1	
Unit				Conte	nts				Contact	
No.									Hrs.	
I	COORD	INATION CHEMISTRY	/						15	
	Werner	's theory, EAN rule, p	biano-stool co	mpounds, va	alence bo	nd theory (i	nner and o	outer orbital		
	complexes), Crystal field theory, d-orbital splitting, weak and strong fields, pairing energies, factors									
	affecting the magnitude of (Δ). Octahedral vs. tetrahedral coordination, tetragonal distortions									
	from octahedral geometry Jahn-Teller theorem, square planar complexes, d orbital splitting in									
	trigonal bipyramidal, square pyramidal and cubic ligand field environments, CFSE, Variation of									
	lattice e	nergies, enthalpies	of hydration a	and crystal ra	idii variat	ions in halic	tes of first	and second		
	row tra	insition metal serie	es, Qualitativ	e aspect o	t Ligand	tield theo	ry, MO c	hagrams of		
	represe	ntative coronation	complexes,	IUPAC non	nenclatur	e of coor	dination (compounds,		
	isomerism in coordination compounds. Stereochemistry of complexes with the coordination									

	number 4 and 6, Chelate effect.	
П	TRANSITION ELEMENTS	15
	General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer & Bsworth diagrams). Difference between the first, second and third transition series. Chemistry of Ti, V, Cr Mn, Fe and Co in various oxidation states (excluding their metallurgy)	
III	LANTHANOIDS AND ACTINOIDS	15
	Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).	
IV	BIOINORGANIC CHEMISTRY	15
	Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine. Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.	
Sugge	ested Readings:	
1	Purcell, K.F & Kotz, J.C. Inorganic Chemistry W.B. Saunders Co, 1977.	
2	 Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993. 	
3	Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.	
4	Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry Wiley-VCH, 1999	
5	Basolo, F, and Pearson, R.C. Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.	
6	5. Greenwood, N.N. & Earnshaw A. Chemistry of the Elements, Butterworth-Heinemann, 19	97.

Course No	lo:	Course Name: Inorganic Chemistry Practical-III				Course Code: SBS CH 020502 C 0042					
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact Hrs	•		
2022		Integrated B.Sc						per Week:	04		
onwards		M.Sc.(Chemistry)	V	0	0	4	2	Total Hrs.:	60		
Total Evaluation Marks: 100		Examinatio	n Duration:	•	6 Hrs.						
CIE: 30 Marks		Pre-requisit	Pre-requisite of course: Qualitative semimicro analysis of mixtures, Synthesis								
TEE: 70	0 Mark	s	of ammine	complexes o	of Ni(II) a	nd its ligand	d exchange	e reactions.			
Course		Qualitative semim	icro analysis	of mixture.	s, Synthe	sis of amm	nine comp	lexes of Ni(II) and its		
Objective	es	ligand exchange re	actions.								
Course		After completing th	is course, stu	dent is expe	cted to le	arn the follo	owing:				
Outcome	es:	CO1: Qualitative se	emimicro ana	alysis of mix	tures con	taining 3 ai	nions and 3	3 cations.			
		CO2: Controlled sy	nthesis of tw	o copper ox	alate hyo	drate comp	lexes				
		CO3: Preparation of	of acetylaceta	anato compl	exes						
		CO4: Synthesis of a	ammine com	plexes							
		CO5: Analysis of co	pper, cadmiu	ım, bismuth,	tin, iron,	aluminum,	chromium,	, zinc radicals			
		CO6: Exchange read	ctions								
			C	OURSE SYLI	ABUS						
NOTE:											
i)Questio	on no. 1	L is compulsory and t	to be set fron	n the entire	syllabus. I	t will have f	four sub-pa	arts and stude	ents need		
to answer	r any t	wo. Each part carries	three and ha	alf marks.							
ii) Questio	on nos	. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will ha	ve three sub-	parts and		
students i	need t	o answer any two su	b-parts of ea	ch question.	Each par	t carries thr	ee and half	f marks.			
Unit				Conte	nts				Contact		
No.									Hrs.		
l 1.	. Qualit	tative semimicro ana	lysis of mixtu	ures containi	ng 3 anio	ns and 3 ca	tions. Emp	hasis should	15		
be an	e giver nalyzeo	n on understanding d:	of the chem	istry of diffe	erent rea	ctions. Follo	owing radi	cals may be			
Ca	arbona	te, nitrate, nitrite	sulphide, su	lphate, sulp	hite ace	tate, fluorio	de, chlorid	e. bromide			
io	dide. k	porate, oxalate, phos	phate, ammo	onium, potas	sium. lea	id. copper. (cadmium. k	pismuth. tin.			
irc	on. al	uminum. chromium	n. zinc. mar	nganese, co	balt. nic	kel. barium	n strontiu	m. calcium.			
m	magnesium Mixtures containing one interfering anion or insoluble component (BaSO ₄ SrSO ₄										
Pb	PbSO ₄ , CaF ₂ or Al ₂ O ₃) or combination of anions e.g. CO_2^{2-} and SO_2^{2-} . NO_2^{-} and $NO_2^{}$. Cl ⁻ and Br ⁻ . Cl ⁻										
an	and Γ , Br and Γ , NO ₃ and Br, NO ₃ and Γ . Spot analysis/tests should be done whenever possible.										
2	. Conti	olled synthesis of t	wo conner o	oxalate hvdr	ate com	olexes: kine	tic vs the	modynamic			
fa	factors.										
3.	. Prepa	aration of acetylacet	anato compl	exes of Cu ²⁺	/Fe ³⁺ . (Al	so find the	λ max of tl	he prepared			
со	omplex	using instrument).									
4.	4. Synthesis of ammine complexes of Ni(II) and its ligand exchange reactions (e.g. bidentate ligands										

	like acetylacetone, DMG, glycine) by substitution method.	
Sugge	sted Readings:	
1. Vog	el's Qualitative Inorganic Analysis, Revised by G. Svehla. Pearson Education, 2002.	
2. Ma	rr & Rockett Practical Inorganic Chemistry. John Wiley & Sons 1972.	

Course	e No:	Course Name: Co					Course Code: SBS CH 020503 C 3104				
Batch		Programme:	y Somostor:	1	т	DDD CH C	Credits	Contact Hrs			
2022		Integrated B.Sc	Jemester.	-	•	•	cicuits	ner Week	04		
onwar	ds	M.Sc. Chemistry	V	3	1	0	4	Total Hrs.:	60		
Total I	Evaluatio	n Marks: 100									
			Examination	n Duration:		3 Hrs.					
CIE:	30 Mar	ks	Pre-requisite of course: Fundamentals of analytical chemistry, Basics of								
			spectroscopic, basics of separation techniques and its applications.								
TEE:	70 Mari	KS	- alution labor	oista Dasios	of an optim	ia bar	ion of come	wation tookai	auton and		
Course		Fundamentals of an	nalytical chen	nistry, Basics	of spectro	oscopic, bas	sics of sepa	ration technic	ques ana		
Course	ives	After completing th	ic courco ctu	dont is over		are the felle	wing				
Course	2	After completing th	is course, stu	dent is exper		arn the folic	wing:				
Outco	mes:	CO1: Familiarization	n with Tundan	nentais of an	alytical cr	toobaiquoo					
		CO2: Dasits of spec	i oscopic, the	an tochnique		nnlications					
		CO3: Learning Dasic	s of separation		s dilu its a	applications	A analytical	chomistry			
		CO5: Understanding	g ariarytical to	111/-Vis spect	roscony	is applied it and its appli	cations	chemistry.			
		CO6: Understanding	g principle of	f thermo-gra	vimetric a	nalvsis and	study of th	hermal decom	nosition		
		of materials/charac	terization of	materials	vinicule	indry 515 and	Study of th		iposition		
		of materialsy charac									
NOTE											
i)Ouos	tion no	1 is compulsory and	to bo cot from	a tha antira (willabur. I	t will baya f		orts and stude	nts nood		
to and	wor any t	T is computed y and	three and h	n the entire s	syllabus. I	t will flave i	our sub-pa	ints and stude	ints need		
	wei ally i	.wo. Each part carries	from all four	units one fro	om each	Every quest	ion will hav	va thraa suh-r	harts and		
studer	ts need t	to answer any two si	ih-narts of ea	ch question	Fach nart	carries thr	e and half	[:] marks			
Unit	its need			Conte	nts				Contact		
No.									Hrs.		
1	QUALIT		TATIVE ASPEC	TS OF ANAL	YSIS				15		
	Tools in	analytical chemistry	and their app	lications, Sar	npling, ev	aluation of	analytical	data, errors,			
	accurac	y and precision, stati	stical test of	data; F, Q ar	nd t-test,	rejection of	data, and	confidence			
	interval	S.									
П	SPECTR	OSCOPY							15		
	Origin o	of spectra, interactio	n of radiatio	n with matt	er, funda	mental law	s of specti	oscopy and			
	selection rules, validity of Beer-Lambert's law.										
	Vibratio	on spectroscopy: Bas	ic principles	of instrumen	tation, sa	mpling tech	niques. Ap	oplication of			
	IR spec	troscopy for charact	erization thre	ough interpr	etation o	f data, Effe	ct and im	portance of			
	isotope	substitution. Introdu	ction to Ram	an spectra							
	UV-Visi	ble Spectrometry: Ba	asic principle	s of instrum	entation,	principles o	f quantita	tive analysis			
	using e	stimation of metal io	ons from aqu	ieous solutio	n, Deterr	nination of	compositi	on of metal			
	complex	xes using Job's metho	od of continue	ous variation	and mole	e ratio meth	od.				

III	THERMAL ANALYSIS and SEPARATION TECHNIQUES	15				
	Theory of thermogravimetry (TG and DTG), instrumentation, estimation of Ca and Mg from their					
	mixture.					
	Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of					
	extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and					
	counter current extractions. Qualitative and quantitative aspects of solvent extraction: extraction					
	of metal ions from aqueous solution, extraction of organic species from the aqueous and non- aqueous media.					
	Chromatography techniques: Classification, principle and efficiency of the technique. Mechanism					
	of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal,					
	elution and displacement methods. Qualitative and quantitative aspects of chromatographic					
	methods of analysis using LC, GLC, TLC and HPLC.					
		45				
IV	ELECTROANALYTICAL METHODS	15				
	Classification of electroanalytical methods, basic principle of pH metric, potentiometric and					
	conductometric titrations. Techniques used for the determination of equivalence points.					
	determination of pKa values.					
1 Mer	sted Readings: Indham J. A. J. Vogel's Quantitative Chemical Analysis 6th Ed. Pearson, 2009					
2 Will	ard. H.H. et al.: Instrumental Methods of Analysis. 7th Ed. Wardsworth Publishing California. USA	A. 1988.				
3.Chri	stian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.	, 1900.				
4 Harr	is. D.C.: Exploring Chemical Analysis. 9th Ed. New York. W.H. Freeman. 2016.					
5 Sko	og. D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis. Saunder College Publ	lications.				
(1998)).	,				
6 Mike	es, O. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood					
John \	John Wiley 1979.					
7 Ditts, R.V. Analytical Chemistry; Methods of separation, van Nostrand, 1974.						
8 Khopkar, S. M., Basic Concepts of Analytical Chemistry, New Age (Second edition)1998						
9.Sko	og D.A., Holler F.J., Nieman T.A., Principles of instrumental analysis, 5th Edn., Brooks & Cole (199	7).				

Course	e No:	Course Name:		Course Code:							
		Analytical Chemistr	y Practical		1	SBS CH 0	20504 C 0	042			
Batch:	:	Programme:	Semester:	L	Т	Р	Credits	Contact Hrs.	•		
2022		Integrated B.Sc						per Week:	04		
onwar	ds	wi.sc.(Chemistry)	V	0	0	4	2	Total Hrs.:	60		
Total Evaluation Marks: 100 Examination Duration: 6 Hrs				6 Hrs.							
CIE:	CIE: 15 Marks Pre-			Pre-requisite of course: Paper chromatographic separation, Determine the							
			pH of the given aerated drinks fruit juices, shampoos and soaps, Estimation								
TEE:	35 Marl	ks	of calcium,	magnesium	n, phospł	nate, nitrat	e, Detern	nination of B	Biological		
			oxygen den	nand (BOD) a	and chem	nical oxyger	n demand	(COD).			
Course	2	Paper chromatogr	aphic separa	tion, Detern	nine the p	oH of the g	iven aerat	ed drinks fru	it juices,		
Object	tives	shampoos and soc	ps, Estimatio	on of calciun	n, magne	sium, phos _l	phate, niti	rate, Determii	nation of		
		Biological oxygen d	emand (BOD)	and chemic	al oxyger	n demand (O	COD).				
Course	e	After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:				
Outco	mes:	CO1 : Chromatogra	phy								
		CO2: Solvent Extra	ctions								
		CO3: Analysis of sc	oil								
		CO4: Ion exchange									
		CO5: Spectrophoto	ometry								
		CO6: Separation of	amino acids	from organ	ic acids b	y ion excha	nge chron	natography.			
			C	OURSE SYLL	ABUS						
NOTE:											
i)Ques	tion no.	1 is compulsory and	to be set fron	n the entire s	syllabus. I	t will have f	our sub-pa	arts and stude	nts need		
to ans	wer any t	wo. Each part carries	s three and ha	alf marks.							
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will ha	ve three sub-p	parts and		
studer	nts need t	to answer any two su	ib-parts of ea	ch question.	Each part	carries thro	ee and half	f marks.			
Unit				Conte	nts				Contact		
No.									Hrs.		
1	CHROM	IATOGRAPHY		3+ • 13+ 1	o 3+				15		
	(I) Pape	r chromatographic se	eparation of F	e st , Al st and	Cr ³						
	(II) Sepa	iration and identifica	tion of the m	onosaccharic	des prese	nt in the giv	en mixture	e (glucose &			
		e) by paper chromato	grapny. Repo	orting the RTV	values.		المناعدة المناط				
	(III.) Sep	their Df values	idan yellow al	na Sudan Keo	a by ILC te	echnique an	a laentity i	them on the			
	(iv) Chr	ulell KI values.	tion of the co	tivo ingradia	nts of pla	nte flowere	and inicce	by TIC			
	(iv) Chro		tion of the ac	live ingredie	nts of pla	nts, nowers	and juices	JUY ILC	15		
"	SOLVEN	IT EXTRACTIONS							12		
	(i) To se	eparate a mixture of	Ni ²⁺ & Fe ²⁺ by	/ complexation	on with D	MG and ex	tracting th	e Ni ²⁺ -DMG			
	complex in chloroform, and determine its concentration by spectrophotometry.										

	ii. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.	
	iii. Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.	
Ш	ANALYSIS OF SOIL	15
	(i) Determination of pH of soil.	
	(ii) Total soluble salt	
	(iii) Estimation of calcium, magnesium, phosphate, nitrate	
IV	ION EXCHANGE and SPECTROPHOTOMETRY	15
	(i) Determination of exchange capacity of cation exchange resins and anion exchange resins.	
	(ii) Separation of metal ions from their binary mixture.	
	(iii) Separation of amino acids from organic acids by ion exchange chromatography.	
	(i). Determination of pKa values of indicator using spectrophotometry.	
	(ii) Structural characterization of compounds by infrared spectroscopy.	
	(iii) Determination of dissolved oxygen in water.	
	(iv) Determination of chemical oxygen demand (COD).	
	(v) Determination of Biological oxygen demand (BOD).	
	(vi) Determine the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job's method.	
Sugge	sted Readings:	
1. Me	ndham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.	
2. Wil Califo	llard, H.H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company,	Belmont,
3 Chr	istian G.D. Anglytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004	
4. Har	ris. D.C. <i>Exploring Chemical Analysis</i> . 9th Ed. New York, W.H. Freeman, 2016.	
5. Kho	pkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009.	
6. Sko	og, D.A. Holler F.J. and Nieman, T.A. <i>Principles of Instrumental Analysis</i> , Cengage Learning India Editi	on.
7. Mil	kes, O. & Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harv	vood Ltd.
Londo	n.	
8. Ditt	s, R.V. Analytical Chemistry: Methods of separation. Van Nostrand, New York, 1974.	

Semester VI

Course	No:	Course Name:	ourse Name:					Course Code:				
		Green Chemistry				SBS CH 02	0601 C 310	04				
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact Hrs	i.			
2022		Integrated B.Sc						per Week:	04			
onward	ds	M.Sc.(Chemistry)	VI	3	1	0	4	Total Hrs.:	60			
Total Evaluation Marks: 100			Examinatio	n Duration:		3 Hrs.						
CIE:	30 Mar	ks	Pre-requisit	Pre-requisite of course: Basic introduction and explaining goals of Green								
			Chemistry,	Chemistry, twelve principles of Green Chemistry, Designing of								
TEE:	70 Marl	ks	Environmer	ntally safe m	arine ant	ifoulant, Co	ombinator	ial green.				
Course		Basic introduction	n and explai	ining goals	of Greer	n Chemistr	y, twelve	principles of	of Green			
Objecti	ives	Chemistry, Designi	ing of Enviror	nmentally sa	fe marine	e antifoular	nt, Combin	atorial green).			
Course	!	After completing th	nis course, stu	dent is expe	cted to lea	arn the follo	wing:					
Outcon	nes:	CO1: Green chemis	try and its pri	nciples.								
		CO2: Green synthes	sis and reaction	ons.								
		CO3: Green chemis	try for sustair	nable solutio	ns.							
		CO4: Understandin	g principles o	f green chem	nistry.							
		CO5: Understandir	ng design of	chemical r	eactions/	chemical sy	nthesis u	sing green o	chemistry			
		principles.										
		CO6: Atom econom	ny and design	of chemical	reactions	using the pi	rinciple.					
					ARIIC							
NOTE			C		ADOS							
NOTE:		4 ······										
I)Quest	tion no.	1 is compulsory and	to be set fron	n the entire s	syllabus. I	t will have f	our sub-pa	arts and stude	ents need			
to answ	ver any t	wo. Each part carries	s three and ha	alt marks.		F	:					
II) Ques	stion nos	5. 2 to 5 are to be set	trom all tour	units one fro	om each.	Every quest	ion will na	ve three sub-	parts and			
studen	ts need	to answer any two st	lo-parts of ea	cn question.	Each par	carries three	ee and nam	r marks.	Contact			
No				Conte	nus				Hrs			
10.	INTROD	UCTION TO GREEN (CHEMISTRY						113.			
•	Basic in	troduction and ex	nlaining goal	ls of Green	Chemist	rv Limitati	ons/Ohsta	cles in the	15			
	nursuit	of the goals of Gree	on Chemistry	is of Green	chemist	ry. Ennicaci	0113/00510					
	pursuit	or the goals of Gree	in chemistry									
	DRINCI								15			
	MINIT	S DURATION FACEN				AL STINI MES	013 (12 ULA	3353 UF 0U				
	Turchas		Shamatatur v 1 1	المعام ماله م		- d						
	i weive	principles of Green C	theorie weis	these series		iu example	s and spec					
	on Designing a Green Synthesis using these principles (Prevention of Waste/ byproducts;											

	maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions)					
III	GREEN SYNTHESIS / REACTIONS	15				
	1. Green Synthesis of adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis).					
	2. Microwave assisted reactions in water: (Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols) and reactions in organic solvents (Diels-Alder reaction and Decarboxylation reaction).					
	3. Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)					
	4 Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments.					
	5 Designing of Environmentally safe marine antifoulant.					
	6 An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.					
	7 Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils					
IV	FUTURE TRENDS IN GREEN CHEMISTRY	15				
	Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; co crystal controlled solid state synthesis (C2S3); Green chemistry in sustainable development.					
Sugge	ested Readings:					
1.Ahlı	uwalia, V.K., Kidwai, M.R. <i>New Trends in Green Chemistry</i> , Anamalaya Publishers (2005).					
2. Anastas, P.T. & Warner, J.K, Green Chemistry- Theory and Practical, Oxford University Press (1998).						
3. Matlack, A.S. Introduction to Green Chemistry, Marcel Dekker (2001).						
4. Car	nn, M.C.and Connely, M.E. Real-World cases in Green Chemistry, ACS (2000).					
5. Rya	in, M.A. and Tinnesand, M. Introduction to Green Chemistry, American Chemical Society, (2002).					
6. Lancaster, M. Green Chemistry: An Introductory Text RSC Publishing, Second Edition, 2010.						

Course N	No:	D: Course Name:					Course Code:				
		Green Chemistry pr	actical			SBS CH 02	0602 C 004	12			
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact Hrs	•		
2022	-	Integrated B.Sc						per Week:	04		
onwards	S	M.Sc. Chemistry	VI	0	0	4	2	Total Hrs.:	60		
Total Ev	aluatio	n Marks: 100	Examinatio	n Duration:		6 Hrs.					
CIE: 1	15 Marl	۲S	Pre-requisit	e of course:	Preparat	ion and cha	iracterizati	on of nanopa	rticles of		
			gold using t	ea leaves, Ex	traction o	of D-limone	ne from or	range peel us	ing liquid		
TEE: 3	35 Marl	(S	CO ₂ prepare	ed form dry io	ce, photo	reduction o	fbenzophe	enone to ben	zopinacol		
			in presence	of sunlight.							
Course	urea Propagation and characterization of nanonarticles of gold using tog logues. Extractic					an of D					
Ohiectiv	IPS	limonana from o	rango nool	usina liquid	CO ₂ pr	of yold usil	ng leu ieu m dru ico	n photorodu	untion of		
Objectiv	/23	henzonhenone to h	unge peer Penzoningcol	in nresence	of sunling	epureu jon ht	ni ury ice	<i>, photoreuu</i>	ετισπ σ		
Course		After completing th	is course stu	dent is exper		arn the follo	wing.				
Outcom	les:	CO1 : Prenaration of	f hiodiesel fro	om vegetable	/ waste o	ooking oil	wing.				
outcom		CO2: Benzoin conde	ensation using	g Thiamine H	vdrochlo	ride as a cat	alvst (inste	ead of cvanide	2).		
		CO3: Solvent free, r	nicrowave as	sisted one po	ot synthes	is of phthal	ocvanine C	Cu(II) complex			
		CO4: Use of molecu	ular model ki	it to stimulat	, the rea	iction	,				
		CO5: Preparation a	nd character	rization of na	anopartic	les of gold	using tea l	eaves			
		CO6: Mechanocher	mical solvent	free synthe	sis of azo	methines	-				
			C	OURSE SYLL	ABUS						
NOTE:											
i)Questio	on no. 1	1 is compulsory and t	to be set fron	n the entire s	syllabus. I	t will have f	our sub-pa	arts and stude	nts need		
to answe	er any t	wo. Each part carries	three and ha	alf marks.							
ii) Quest	tion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will hav	ve three sub-	parts and		
students	s need t	o answer any two su	b-parts of ea	ch question.	Each part	carries thre	ee and half	marks.			
Unit				Contei	nts				Contact		
No.									Hrs.		
I P	PREPAR	ATIONS AND STUDY	OF REACTIO	NS-I					15		
1	1. Prepa	ration and character	ization of nar	noparticles of	f gold usir	ng tea leave	S.				
2	2. Prepa	ration of biodiesel fr	om vegetable	e/ waste cool	king oil.						
3	3. Use d	of molecular model I	kit to stimula	ite the reacti	ion to inv	estigate ho	w the ato	m economy			
	IIIustrates Green Chemistry.										
4	4. Reactions like addition, elimination, substitution and rearrangement may also be studied for the										
	Laiculati										
	PREPARATIONS AND STUDY OF REACTIONS-I										
1	1. Benzo	oin condensation usir	ng Thiamine H	Hydrochloride	e as a cata	alyst (instea	d of cyanic	le).			
2	2. Extra	ction of D-limonene f	rom orange	peel using liq	uid CO ₂ p	repared for	m dry ice.				
3	3. Mech	anochemical solvent	free synthes	is of azometh	nines						

	4. Solvent free, microwave assisted one pot synthesis of phthalocyanine Cu(II) complex.							
	5. Photoreduction of benzophenone to benzopinacol in presence of sunlight.							
Sugge	sted Readings:							
1. Ana	1. Anastas, P.T & Warner, J.C. Green Chemistry: Theory and Practice, Oxford University Press (1998).							
2. Kiro	choff, M. & Ryan, M.A. Greener approaches to undergraduate chemistry experiment. American	Chemical						
Societ	y, Washington DC (2002).							
3. Rya	n, M.A. Introduction to Green Chemistry, Tinnesand; (Ed), American Chemical Society, Washington D	C (2002).						
4. Sha	rma, R.K.; Sidhwani, I.T. and Chaudhari, M.K. I.K. Green Chemistry Experiment: A monograph, Inter	rnational						
Publis	hing ISBN 978-93-81141-55-7 (2013).							
<i>5.</i> Can	n, M.C. and Connelly, M. E. Real world cases in Green Chemistry, American Chemical Society (2008).							
6. Can	n, M. C. and Thomas, P. Real world cases in Green Chemistry, American Chemical Society (2008).							
7. Lan	caster, M. Green Chemistry: An Introductory Text RSC Publishing, Second Edition, 2010.							
0 000	in D.L. Lompmon, C.M. Kriz, C.C. & Engol, D.C. Introduction to Organic Laboratory Tophniques: A.M.	ierocarlo						

8. Pavia, D. L., Lampman, G.M., Kriz, G.S. & Engel, R.G. *Introduction to Organic Laboratory Techniques: A Microscale and Macro Scale Approach,* W.B.Saunders, 1995.

Course	e No:	Course Name:					Course Code:				
		Materials Chemistry SE				SBS CH 020603 C 3104					
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact Hrs			
2022		Integrated B.Sc						per Week:	04		
onwar	ds	M.Sc. Chemistry	VI	3	1	0	4	Total Hrs.:	60		
Total I	Evaluatio	n Marks: 100	Examination	n Duration:	•	3 Hrs.					
CIE.											
CIE:	30 Iviari	<s s<="" td=""><td>Pre-requisit</td><th>e of course:</th><td>Knowledg</td><td>ge of materia</td><td>als synthes</td><th>is and charac</th><td>terization,</td></s>	Pre-requisit	e of course:	Knowledg	ge of materia	als synthes	is and charac	terization,		
TEE	70 Marl	/s	application	of various ma	aterials su	ich as zeolit	es.				
Course		Crystalline solids o	rvstal system	s Bravais la	ttices cou	ordination r	umher In	traduction to	<i>Teolites</i>		
Ohiect	tives	Prenaration of ino	raanic solids	Overview (of nanost	ructures ar	id nano-m	naterials Intr	oduction		
0.5,000		limitations of conve	ntional enain	eerina mate	rials.	ructures un			ouuction,		
Course	9	After completing th	is course. stu	dent is expe	cted to lea	arn the follo	wing:				
Outco	Outcomes: CO1: Crystalline solids – parameters, symmetry,										
	CO2 : Silica based materials in applications.										
		CO3: Technological	importance of	of ionic liquid	ls, prepar	ation of mat	terials– usi	ing sol-gel tec	hnique.		
		CO4: Nano-structur	ed materials,	self-assemb	led struct	ure.			-		
		CO5: Composites a	nd its applicat	tions							
		CO6: Understandin	g basic param	neters of crys	talline so	lids, symme	try and cry	stal structure	es.		
			C	OURSE SYLL	ABUS						
NOTE:											
i)Ques	tion no. 2	1 is compulsory and	to be set fron	n the entire s	syllabus. I	t will have f	our sub-pa	arts and stude	ents need		
to ans	wer any t	wo. Each part carries	s three and ha	alf marks.							
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will ha	ve three sub-	parts and		
studer	nts need t	to answer any two su	b-parts of ea	ch question.	Each part	t carries thre	ee and half	f marks.			
Unit				Conte	nts				Contact		
No.									Hrs.		
I	BASICS	OF CRYSTALLINE SOI	.IDS						15		
	Crystall	ine solids, crystal s	ystems, Brav	ais lattices,	coordina	ntion numb	er, packin	ng factors –			
	cubic, ł	nexagonal, diamono	l structures,	lattice plan	es, Mille	r indices, i	nterplana	r distances,			
	directio	ns, types of bonding	g, lattice ene	ergy, Madelu	ing const	ants, Born	Haber cyc	le, cohesive			
	energy,	Symmetry elemen	ts, operation	ns , translat	ional syr	nmetries -	point gro	oups, space			
	groups,	equivalent position	is, close pack	ed structure	es, voids,	crystal stru	ictures, Pa	auling rules,			
	defects	in crystals, polymor	phism, twinr	ning.							
II	SILICA B	ASED MATERIALS							15		
	Introduo	ction to Zeolites,	metallosilica	tes, silicalit	es and	related m	icroporous	materials,			
	Mesopo	orous silica, metal c	ides and re	elated functi	onalized	mesoporou	is materia	ls: Covalent			
	organic	frameworks, Organio	c-Inorganic hy	brid materia	ls, period	ic mesoporc	ous organo	silica, metal			
	organic	nic frameworks: H_2 /CO ₂ gas storage and catalytic applications.									

Ш	INORGANIC SOLIDS/IONIC LIQUIDS OF TECHNOLOGICAL IMPORTANCE	15				
	Preparation of inorganic solids: Conventional heat and beat methods, Co-precipitation					
	method, Sol-gel methods, Hydro-thermal method, Ion-exchange and Intercalation methods.					
	Introduction to Solid electrolytes, inorganic liquid crystals. Ionic liquids, forces responsible for					
	ionic liquids, synthesis and application of imidazolium and phosphonium based ionic liquids.					
	Host-guest chemistry (elementary ideas).					
IV	NANOMATERIALS and COMPOSITE MATERIALS	15				
	Overview of nanostructures and nano-materials: classification. Preparation of gold and silver					
	metallic nanoparticles, self-assembled nanostructures-control of nano-architecture-one					
	dimensional control. Carbon nanotubes and inorganic nanowires.					
	Introduction, limitations of conventional engineering materials, role of matrix in composites,					
	classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix					
	composites, fibre-reinforced composites, environmental effects on composites, applications of					
	composites.					
Sugge	ested Readings:					
1.Atki	ns P, Overton T., Rourke J. Weller M. and Armstrong F Shriver and Atkins. Inorganic Chemistry Oxford L	Jniversity				
Press,	Press, Fifth Edition, 2012.					
3. Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley,						
4. Poole, C.P. & Owens, F.J. Introduction to Nanotechnology John Wiley 2003.						
5. Roc	lger, G.E. Inorganic and Solid-State Chemistry, Cengage Learning, 2002.					

Course	e No:	Course Name:				Course Code:					
		Materials Chemistr	Chemistry Practical SBS CH 020604 C 0042								
Batch	:	Programme:	Semester:	L	Т	Р	Credits	Contact Hrs			
2022		Integrated B.Sc						per Week:	04		
onwar	ds	M.Sc. Chemistry	VI	0	0	4	2	Total Hrs.:	60		
Total I	Evaluatio	n Marks: 100	Examinatio	n Duration:		6 Hrs.					
CIE:	CIE: 15 Marks			Pre-requisite of course: Preparations of novalac resin/resol resin, Synthesis							
TEE:	35 Mar	ks	Preparation of silver nano material.								
Course	2	Preparations of nov	' valac resin/re	sol resin. Svr	nthesis of	materials/p	orous mat	erials. Analvs	is of XRD		
Object	Objectives pattern of crystals, Preparation of silver nano material.							,			
Course	е	After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:				
Outco	mes:	CO1: Preparation o	f urea-formal	dehyde resir	ı		-				
		CO2: Analysis of XF	RD pattern of	crystals.							
		CO3: Interpretation	of FTIR, NMI	R and UV-Vis	data of g	iven materia	al.				
		CO4: Determination	n of hydratior	n number IR s	spectra.						
		CO5: Preparations	of novalac re	esin/resol re	sin.						
		CO6: Preparation of	of silver nano	material.							
			C	OURSE SYLL	ABUS						
NOTE:	:										
i)Ques	stion no.	1 is compulsory and	to be set fron	n the entire s	syllabus. I	t will have f	our sub-pa	arts and stude	ents need		
to ans	wer any t	wo. Each part carries	s three and h	alf marks.							
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	on will hav	ve three sub-	parts and		
studer	nts need t	to answer any two su	b-parts of ea	ch question.	Each part	t carries thre	ee and half	f marks.			
Unit				Conte	nts				Contact		
No.									Hrs.		
I	PREPAR	ATIONS OF MATERIA	ALS						30		
	1. Prepa	aration of urea-form	haldehyde re	sin							
	2. Prepa	arations of novalac i	resin/resol re	esin							
	3. Synt	hesis of materials/	porous mate	erials (Sol-ge	el, hydrot	thermal, m	icrowave)	. (Similarly,			
	other m	naterials synthesis ca	an be design	ed).							
	4. Prep	aration of silver n	ano materia	I. (Similarly,	, other r	nano mater	ials of ot	her metals			
	synthes	is can be designed).									
	СПУру		TEDIAIS						20		
	1 Analy	usis of XRD nattern (of crystale						50		
	2 Inter	nretation of ETID NI	MR and LIV V	lis data of di	ven mate	rial					
	2. Intel 2. Ectim	pictation of narticle size	e from the P	FT SEM tool	niques						
	J. Latin 4 Dens	ity measurement of	ionic liquide		inques.						
	5 Dete	rmining dynamic vis	cosities of ai	ven ionic lia	uids						
	6 Deto	rmination of hydrati	ion number l	R spectra	4143						
	6. Determination of hydration number ik spectra.										

67 | P a g e

1. Atkins P, Overton T., Rourke J. Weller M. and Armstrong F *Shriver and Atkins. Inorganic Chemistry* Oxford University Press, Fifth Edition, 2012.

3. Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley, 1974.

4. Poole, C.P. & Owens, F.J. Introduction to Nanotechnology John Wiley 2003.

5. Rodger, G.E. Inorganic and Solid-State Chemistry, Cengage Learning, 2002.

Sr. No.	Name of the course	Course Code	L	T/ P	Р	Credits
1	English for Communication	SBS CH 0201 AE 3104	3	1	0	4
2	History of Indian Science	SBS CH 0202 AE 3104	3	1	0	4
3	Good Laboratory Practices	SBS CH 0203 AE 3104	3	1	0	4
4	Cheminformatics	SBS CH 0204 AE 3104	3	1	0	4
5	Research methodology	SBS CH 0205 AE 3104	3	1	0	4
6	Chemistry in Everyday life	SBS CH 0206 AE 3104	3	1	0	4

List of Ability Enhancement Courses

Course	e No:	Course Name:				Course Code:			
Datah			Comparter:		-		201 AE 31		
Datch		Programme:	Semester:	L	1	P	Credits		. 04
2022 Onwai	rds	M Sc Chemistry	1/11	2	1	0	1	Total Hrs :	60
Total	Fvaluatio	n Marks: 100	1/ 11	5	L	0	4	Total His	00
Totari	Lvaluatio		Examinatio	n Duration:		3 Hrs.			
CIE:	30 Mar	ks	Pre-requisit	e of course	: Idea of	general Er	nglish, Eng	glish gramma	ır, English
TEE:	70 Marl	<s< td=""><td>Sentence inc</td><th>annig.</th><td></td><td></td><td></td><td></td><td></td></s<>	Sentence inc	annig.					
Course	2	To skill students ir	n English con	nmunication,	in Englis	sh writing, t	technical v	vriting in Eng	glish and
Object	tives	scientific or general	l science pres	entation in Ei	nglish.				
Course	е	After completing th	nis course, stu	dent is expe	cted to lea	arn the follo	wing:		
Outco	mes:	CO1: Understandin	g of language	and differen	itiate betv	ween writing	g and spee	ch	
		CO2: Understandin	g of way of w	riting thesis a	and argun	nentative w	riting		
		CO3: Understandin	g the differen	ice between	formal an	d informal v	writing		
		CO4: Understandin	g the differen	it forms of te	chnical w	riting			
		COS: Understandin	g of avoiding	the common	errors	-			
			g Of Making a	scientine pre	esentation	1			
			C	OURSE SYLL	ABUS				
NOTE:									
i) Que	stion no.	1 is compulsory and	to be set from	the entire s	yllabus. It	will have se	ven sub-pa	arts and stude	ents need
to ans	wer any f	our. Each part carrie	s three and h	alf marks.		_			
ii) Que	estion nos	s. 2 to 5 are to be set	trom all tour	units one fro	om each.	Every quest	ion will hav	ve three sub-	parts and
studer	its need i	to answer any two st	lo-parts of ea	Contor.	Each part	carries sev	en marks.		Contact
No.				Conte	iits				Hrs.
I	сомм	JNICATION							15
	Languag	ge and communicatio	on, differences	s between sp	eech and	writing, dist	inct featur	es of speech,	
	distinct	features of writing.							
									15
	Selectio	n of tonic thesis	statement	developing	the the	is: introdu	ctory dev	velonmental	15
	transitio	anal and concluding	naragranhs	linguistic u	nity cohe	erence and	cohesion	descriptive	
	narrativ	e. expository and are	gumentative v	writing.	incy, cond		concoron,	acscriptive,	
			50						
III	TECHNI	CAL WRITING							15
	Scientifi	c and technical su	ubjects; form	nal and info	ormal wr	itings; forn	nal writin	gs/reports,	
	handbo	oks, manuals, letter	s, memorand	lum, notices,	agenda,	minutes; c	ommon er	rors to be	
	avoided								
IV	PRESEN	TATION SKILL							15
	Scientifi	c presentation, pres	entations rela	ited to gener	al topic o	f science, ar	nimation, e	diting.	

- 5. O. Blackswan, Language, Literature and Creativity (2013).
- 6. Business English, Pearson (2008).
- 7. Fluency in English-Part II, Oxford University Press (2006).
- 8. Dr. G. Mishra, Dr. R. Kaul and Dr. B. Biswas, Language through Literature (forthcoming) Edition.

Course	e No:	Course Name: Course Code: SBS_CH 0202_AE 3104								
Batch	•	Programme:	Semester:	I	т	P	Credits	Contact Hrs		
2022	•	Integrated B Sc -	Semester.	-	•	•	cicuits	ner Week:	04	
Onwa	rds	M.Sc. Chemistry	1/11	3	1	0	4	Total Hrs.:	60	
Total	 Fvaluatio	n Marks: 100	.,	3	-	Ŭ	•	rotur mon		
. otar .			Examinatio	n Duration:		3 Hrs.				
CIE:	30 Mar	٢S	Due un minist				م الم ما الم			
			Pre-requisit	e of course:	Knowledg	ge of history	of India, k	nowledge of	important	
TEE:	70 Marl	(S								
Course	2	To provide students	a knowledge	e of advancer	ment in ai	ncient sciend	e and the	progress it m	ade after	
Object	bjectives independence and path breaking research by prominent scientists									
Course	e	After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:			
Outco	mes:	CO1: Understanding	g of innovatio	ons and deve	lopment i	n science in	ancient In	dia		
		CO2: Understanding	g of research	organization	s like CSIF	R, DRDO, ICA	R and ICM	1R		
		CO3: Understanding	g about the p	rominent sci	entists wh	no have take	n Indian s	cience to inte	rnational	
		level								
		CO4: Understanding	g of history of	f plant tissue	culture in	n India				
		CO5: Understanding	g of the greer	n revolution i	n India, fi	rst gene clo	ning and fi	rst genome se	equencing	
		CO6: Understanding	g of allelopat	hy plant rese	arch in In	dia				
			C	OURSE SYLI	ABUS					
NOTE:										
i) Que	stion no.	1 is compulsory and t	o be set from	the entire s	yllabus. It	will have se	ven sub-pa	arts and stude	ents need	
to ans	wer any f	our. Each part carrie	s three and h	alf marks.						
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	on will ha	ve three sub-	parts and	
studer	nts need t	to answer any two su	b-parts of ea	ch question.	Each part	t carries sev	en marks.			
Unit				Conte	nts				Contact	
No.									Hrs.	
1	SCIENCE	: IN ANCIENT AND IV	IEDIEVAL IND	1A thomatics o	nginoorin	a and madi	ino cubioc	to in Ancient	15	
	India II	of development in as	and iron in A	ncient India		g anu meuic ranhy in lite	rature of A	ncient India		
	Influence	e of the Islamic world	and Furope	on developm	nents in th	e fields of m	athematic	s. chemistry.		
	astrono	my and medicine.	innovations	in the field	of agric	ulture-new	crop intro	oduced new		
	techniq	ues of irrigation.								
11	INDIAN	SCIENCE IN BEFORE	AND AFTER I	NDEPENDEN	ICE				15	
	Introdu	ction of different surv	veyors, botan	ists and doct	ors as eau	rly scientist i	n Colonial	India, Indian		
	percept	ion and adoption for	new scientif	ic knowledge	e in Mode	ern India, Est	tablishmer	nt of premier		
	researc	n organizations like	CSIR, DRDO	and ICAR a	nd ICMR,	Establishm	ent of At	omic Energy		
	Commis	sion, Launching of th	e space satel	lites, Botanio	cal survey	of India.				
III	PROMI	NENT INDIAN SCIENT	ISTS						15	
	Eminen	t scholars in mathe	ematics and	astronomy:	Baudhay	ana, Aryab	htatta, Br	ahmgupta,		
	Bhaskar	acharya, Varahamihi	ra, and Naga	rjuna, Medio	al science	e of Ancient	India (Ayı	urveda and		
	Yoga): S	Susruta, Charak. Scie	entists of Mo	dern India:	Srinivas F	Ramanujan,	C.V. Rama	an, Jagdish		
	Chandra	a Bose, Homi Jehangi	r Bhabha and	l Vikram Sara	ibhai.					
IV	PROMINENT RESEARCH IN PLANT SCIENCES IN REPUBLIC OF INDIA History of plant tissue culture from India, Green revolution in India: causes, details, and outcomes. First gene cloning in plants, First genome sequencing from India. Premier Plant Research institutes and scientists in India, GM Mustard. Allelopathy Plant research in India.	15								
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Sugge	sted Readings:									
1.	Kuppuram G (1990) History of Science and Technology in India, South Asia Books.									
2.	2. Handa O. C. (2014) Reflections on the history of Indian Science and Technology, Pentagon Press									
3.	3. Basu A (2006) Chemical Science in Colonial India: The Science in Social History, K.P. Bagchi & Co.									
4.	4. Habib I, (2016.) A people's history of India 20: Technology in Medieval India, 5th Edition, Tulika E	Books.								
5.	5. A. Rahman et al (1982) Science and Technology in Medieval India – A Bibliography of Source Ma	terials in								
	Sanskrit, Arabic and Persian, New Delhi: Indian National Science Academy.									
6.	6. B. V. Subbarayappa & K. V. Sarma (1985), Indian Astronomy — A Source Book, Bombay.									
7.	7. Srinivasan S, Ranganathan S (2013) Minerals and Metals heritage of India, National Institute of A	Advanced								
	Studies.									
8.	8. Srinivasiengar C N, (1967) The History of Ancient Indian Mathematics, World Press Private Ltd. C	Calcutta.								
9.	9. Bhardwaj H C (2000) Metallurgy in Indian Archaeology. Tara Book Agency									

Cours	e No:	Course Name: Course Code:											
		Good Laboratory Pr	actices			SBS CH 0	203 AE 31	04					
Batch		Programme:	Semester:	L	Т	Р	Credits	Contact Hrs	•				
2022		Integrated B.Sc						per Week:	04				
Onwa	rds	M.Sc. Chemistry	1/11	3	1	0	4	Total Hrs.:	60				
Total	Evaluatio	n Marks: 100	Examinatio	n Duration:		3 Hrs.							
CIE:	30 Marl	<s< th=""><th>Pre-requisit</th><th>e of course</th><th>: Experie</th><th>nce of worl</th><th>king in sci</th><th>ence laborat</th><th>ories and</th></s<>	Pre-requisit	e of course	: Experie	nce of worl	king in sci	ence laborat	ories and				
TEE:	70 Marl	<s< th=""><th>accessories.</th><th>зпап ехре</th><th>ninents,</th><th>Kilowieuge</th><th></th><th>atory equip</th><th></th></s<>	accessories.	зпап ехре	ninents,	Kilowieuge		atory equip					
Cours	2	To skill students in	laboratory pr	actices, instr	ument us	age, safety	practice li	ke handling a	cids with				
Objec	tives	care						_					
Cours	e	After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:						
Outco	mes:	CO1: Understandin	g of common	calculations									
		CO2: Understandin	g of preparat	ion of solutio	ns of diffe	erent norma	lity and m	olarity					
	CO3: Understanding the use of different instruments												
CO4: Understanding of preparation of crystals, dyes													
CO5: Understanding of safety precautions while in laboratory													
		COB: Understandin	g of Importan	ice of cleanili	ness in lac	oratory							
			C	OURSE SYLL	ABUS								
NOTE													
i) Que	stion no.	1 is compulsory and	to be set from	the entire s	yllabus. It	will have se	ven sub-pa	arts and stude	ents need				
to ans	wer any f	our. Each part carrie	s three and h	alf marks.									
ii) Que	estion nos	. 2 to 5 are to be set	from all four	units one fro	om each. I	Every questi	on will ha	ve three sub-	parts and				
stude	nts need t	o answer any two su	ib-parts of ea	ch question.	Each part	carries sev	en marks.		0				
Unit				Conte	nts				Contact				
10.	GENIEDA								пг з. 15				
•	Commo	n calculations in che	mistry labora	tories. Unde	rstanding	the details	on the lab	el of reagent	15				
	bottles.	Preparation of solu	tions. Molarit	y and norma	ality of co	mmon acid	s and base	es. Dilutions.					
	Percent	age solutions. Mola	r, molal and	normal solut	ions. Tecl	nnique of h	andling m	icropipettes;					
	Knowle	dge about common t	oxic chemica	ls and safety	measures	s in their ha	ndling.						
II	INSTRU	MENT-TECHNIQUES	AND LABOR/	TORY PREP	ARATION	PROCEDUR	E		15				
	Use of	micropipette, analy	tical balance	es, pH mete	Use of micropipette, analytical balances, pH meter, conductivity meter, rotary evaporator,								
potentiometer. Use of purified water in lab experiments, Cleaning and drying of glasswares,													
Perpartion of crystals from given salt. Preparation of Dyes, Demonstration of preparation of material using Sol gol procedure								anavation of					
	Perparti	Lusing Sol-gel proces	luro	Freparation	ments, Cl of Dyes,	Demonstra	ton of pr	eparation of					
	Perparti materia	l using Sol-gel proce	dure.	riepalation	ments, Cl of Dyes,	Demonstra	ton of pro	eparation of	15				
111	Perparti materia GENERA Precaut	I using Sol-gel proced	dure. S rear safety go	nogles and s	nents, Cl of Dyes,	Demonstra	ton of pro	eparation of	15				
111	Perparti materia GENERA Precaut chemica	I using Sol-gel proced L SAFETY PRACTICE ious use of acids, w Is with much care. w	dure. S ear safety go vear labcoat.	bogles and s	ments, Cl of Dyes, hoes in la	aboratory, u	ton of pro	nguishable	15				
	Perparti materia GENERA Precaut chemica	I using Sol-gel proced L SAFETY PRACTICE ious use of acids, w ils with much care, w	dure. S ear safety go ear labcoat.	bogles and s	ments, Cl of Dyes, hoes in la	aboratory, u	ton of pro	eparation of nguishable	15				

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

Course	e No:	Course Name:Course Code:CheminformaticsSBS CH 0204 AE 3104									
Batch:		Programme:	Semester: L T P Credits Contact Hrs.								
2022		Integrated B.Sc		_	-	-	0.00.00	per Week:	04		
Onwar	rds	M.Sc. Chemistry	1/11	3	1	0	4	Total Hrs.:	60		
Total I	Evaluatio	n Marks: 100	Examinatio	n Duration:		3 Hrs.					
CIE: TEE:	30 Mar 70 Marl	ks <s< td=""><th>Pre-requisit related soft</th><th>e of course: wares.</th><th>Knowled</th><td>ge of comp</td><td>uter aided</td><th>support in C</th><td>Chemistry,</td></s<>	Pre-requisit related soft	e of course: wares.	Knowled	ge of comp	uter aided	support in C	Chemistry,		
Course Object	e tives	To skill students abo chemical structures	out chemoinfo and its appli	ormatics, nor cations	nenclatur	e, reaction c	classificatio	on, proper sea	rching of		
Course Outco	 After completing this course, student is expected to learn the following: CO1: Understanding of prospects of chemoinformatics CO2: Understanding of nomenclature and reaction classification CO3: Understanding on how to search chemical structure CO4: Understanding the properties of compounds and structure and property relations CO5: Understanding the computational chemistry in elucidation of structure and design of synthesis CO6: Understanding of drug design, target identification and optimization 										
			C	OURSE SYLL	ABUS						
i) Ques to ansv ii) Que	stion no. wer any f	1 is compulsory and f our. Each part carrie 5. 2 to 5 are to be set	to be set from s three and h from all four	the entire s alf marks. units one fro	yllabus. It om each.	will have se Every quest	ven sub-pa ion will hav	arts and stude ve three sub-p	ents need parts and		
llnit	its need i	to answer any two st	ib-parts of ea	Conte	tacii pari	. carries sev	en marks.		Contact		
No.				conte	1115				Hrs.		
1	INTROD	UCTION TO CHEMO	NFORMATIC	S					15		
	History,	Prospects of chemo	informatics, N	Aolecular Mo	delling a	nd Structure	elucidatio	on.	-		
П	REPRES	ENTATION OF MOLE	CULES AND C	HEMICAL RE	ACTIONS				15		
	Nomen	clature, Different typ	es of notatio	ons, SMILES o	oding, M	atrix repres	entations,	Structure of			
	Molfiles	and Sdfiles, Librarie	s and toolkits	, Different el	ectronic e	effects, Read	tion classi	fication.			
III	SEARCH	IING CHEMICAL STRU	JCTURES						15		
	Full stru	ucture search, sub-s	tructure sea	rch, basic id	eas, simi	arity search	n, three d	imensional			
	search r	methods, basics of co	omputation o	f physical an	d chemica	al data and s	structure d	escriptors,			
	data vis	ualization.									
IV	APPLICA	ATIONS							15		
	Prediction of Properties of Compounds; Linear Free Energy Relations; Quantitative Structure- Property Relations; Descriptor Analysis; Model Building; Modeling. Toxicity; Structure-Spectra correlations; Prediction of NMR, IR and Mass spectra; Computer										
	Target I Screenii in Drug	dentification and Va ng; Design of Combin Design.	lidation; Lead	Finding and Finding and	Optimiza d structu	tion; Analys	sis of HTS of generation and the second s	data; Virtual Applications			

- 1. Andrew R. Leach and Valerie, J. Gillet (2007) An introduction to Chemoinformatics. Springer: The Netherlands.
- 2. Gasteiger, J. and Engel, T. (2003) Chemoinformatics: A text-book. Wiley-VCH.
- 3. Gupta, S. P. (2011) QSAR & Molecular Modeling. Anamaya Pub.: New Delhi.

Cours	e No:	Course Name: Course Code:									
		Research methodo	ogy	I	I	SBS CH 0	205 AE 31	04			
Batch	:	Programme:	Semester:	L	Т	Р	Credits	Contact Hrs	•		
2022		Integrated B.Sc						per Week:	04		
Onwa	rds	M.Sc. Chemistry	1/11	3	1	0	4	Total Hrs.:	60		
Total	Evaluatio	n Marks: 100	Examinatio	n Duration:		3 Hrs.					
CIE:	30 Marl	ks	Pre-requisit	e of course:	Knowledg	e of researc	h, good pra	actices in rese	arch, idea		
TEE:	70 Marl	٢S	or journals a	and publication	ons.						
Course	8	To skill students a	bout researc	h, different i	types of	research, d	ata collect	ion and publ	ishing of		
Object	tives	research work									
Course	е	After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:				
Outco	mes:	CO1: Understandin	g of different	types of rese	earch						
		CO2: Understandin	g of research	methods and	d method	ology					
		CO3: Understandin	g the data col	llection and r	naintainir	ng laborator	y record				
		CO4: Understandin	g the differen	it research ar	eas of ch	emistry					
		CO5: Understandin	g of various in	nstruments to	o charact	erize the res	search				
COB: Understanding of publication of research											
			C	OURSE SYLL	.ABUS						
NOTE:											
i) Que	stion no.	1 is compulsory and	to be set from	n the entire s	yllabus. It	will have se	ven sub-pa	arts and stude	ents need		
to ans	wer any f	our. Each part carrie	s three and h	alf marks.							
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will hav	ve three sub-	parts and		
studer	nts need t	to answer any two su	ib-parts of ea	ch question.	Each par	t carries sev	en marks.		Contont		
Unit				Conte	nts				Contact		
INO.			СН						<u>піз.</u> 15		
•	Researc	h-definition and typ	bes of resear	ch (Descript	ive vs ar	nalytical: an	plied vs f	undamental:	13		
	quantita	ative vs. qualitative	; conceptua	l vs empirio	cal). Rese	earch meth	iods vs m	nethodology.			
	Literatu	re-review and its cor	solidation; Li	brary resear	ch; field r	esearch; lab	oratory res	search.			
II	DATA C	OLLECTION AND DO	CUMENTATIC	ON OF OBSEF	VATIONS	5			15		
	Maintai	ning a laboratory rec	ord; Tabulatio	on and gener	ation of g	raphs. Imag	ing of tissu	ie specimens			
	and app	lication of scale bars	. The art of fi	eld photogra	phy.						
III OVERVIEW OF APPLICATION TO CHEMISTRY RELATED PROBLEMS 1								15			
Key chemistry research areas, chemoinfomatics.											
IV	IV BASIC KNOWLEDGE OF PUBLICATION HOUSE, JOURNALS AND INSTRUMENTATION								15		
	Characterization of samples, Instruments used for characterization, Publish the research, Access										
	differen	t publication house a	and journals a	issociated wi	th it, Rese	earch article	s.				

- 1. A. Fink, Conducting Research Literature Reviews: From the Internet to Paper, Sage Publications, 2009.
- 2. M. Graziano, A.M. Anthony and M. L. Raulin, Research Methods: A Process of Inquiry, Allyn and Bacon., 2009.
- 3. W. M. K. Trochim, Research Methods: the concise knowledge base, Atomic Dog Publishing, 2005.
- 4. P. D. Leedy and J. E. Ormrod, Practical Research: Planning and Design, Prentice Hall, 2004.
- 5. B. L. Garg, R. Karadia, F. Agarwal and U. K. Agarwal, An introduction to Research Methodology, RBSA Publishers, 2002.
- 6. R. A. Day, How to Write and Publish a Scientific Paper, Cambridge University Press, 1992.
- 7. C. R. Kothari, Research Methodology: Methods and Techniques, New Age International, 1990.

Course	e No:	Course Name:	lav life			Course Co	de: 206 AF 31	04		
Batch		Brogrammo:	Somostor:		т		Crodite	Contact Hrs		
2022		Integrated B Sc -	Semester.	L		F	creats	Contact His	04	
2022 0pw2i	de	M Sc. Chemistry	1/11	2	0	2	4		60	
Tatal		n Markey 100	1/ 11	Z	0	Z	4		00	
TOLATI	zvaluatio	n warks: 100	Examination	Duration:		3 Hrs.				
CIE:	30 Marl	٢S	Pre-requisite	e of course:	Knowled	ge of differe	nt chemica	al processes p	eople use	
TEE:	70 Marl	<s< td=""><th></th><th>yaay me me</th><td></td><td></td><td></td><th></th><td></td></s<>		yaay me me						
Course Object	e tives	To teach students h human health, vitai	ow much cher min and miner	mistry is an al chemistry	integral p V,	art of our ev	eryday life	e, impact of ra	dicals on	
Course	9	After completing th	is course, stud	dent is expe	cted to lea	arn the follo	wing:			
Outco	mes:	CO1: Understanding	g of mechanis	m of energy	production	on via respii	ratory syst	em		
		CO2: Understanding	g of chemistry	behind haz	ardous di	seases				
		CO3: Understanding	g the mechani	sm behind t	the forma	tion and wo	rking of ev	veryday life po	olymeric	
	materials									
	CO4: Understanding role of vitamins and minerals in body and their working mechanism									
	CO5: Understanding of radical production and their impact on health									
		CO6: Understanding	g of superoxid	e, peroxide	and anti-	oxidants				
			CC	OURSE SYLI	LABUS					
NOTE:										
i) Que	stion no.	1 is compulsory and t	o be set from	the entire s	yllabus. It	will have se	even sub-p	arts and stude	ents need	
to ans	wer any f	our. Each part carrie	s three and ha	alf marks.						
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fr	om each.	Every quest	ion will ha	ve three sub- _l	parts and	
studer	nts need t	o answer any two su	b-parts of eac	ch question.	Each par	t carries sev	en marks.			
Unit				Conte	nts				Contact	
No.									Hrs.	
I I	RESPIRA	ATION AND ENERGY	PRODUCTION	IN HUMAN	BODY				15	
	Respirat	tion, Respiratory enz	ymes, brief o	utline of he	moglobin	and myogl	obin, oxyg	en transport		
	mechan	ism in body, co-ope	erativity, Resp	iration in lo	ower anir	nals, hemou	cyanine, h	emerythrine.		
	Energy	production in body,	chrome c-oxid	e responsic	DIE TOT TO	oa algestio	n, mecnan	ism of tood		
	CHEMIC							ΔΤΕΒΙΔΙς	15	
	Anemia	sickle cell anemia	leukemia blo	od pressure	irregulat	tion blood	sugar arth	ritis carbon	15	
	monovi	de poisoning in mine	s. cvanide noi	soning fluo	rosis etc		Sugar, arti			
	Soans a	nd Detergents – thei	raction Riof	iels – nrodu	rtion of h	iofuels and	its utility a	s alternative		
	fuel sou	rce Fibers: natural fi	hers cotton y	vool silk ra	von artifi	cial fihers r	nolvamides	acrylic acid		
		A: Examples of natu	ral biodegrad	able nolym	ers cellul	ose cellulo	se acetate	cellonhane		
	sov protein corn zein protein wheat gluten protein synthetic higdegradable polymers. Use of									
	polvme	ric materials in daily	life.		., synthet					
111	II VITAMINS AND MINERALS 1								15	
	Need for vitamin in body, types of vitamins, water soluble and fat soluble vitamins. Vitamin B-12,							-		
	vitamin	C (Cyanocobalamin	e), D, Vitamir	K. Role of	minerals	s in body, i	odine defi	ciency and		
	remedv		·· · ·	-	-			,		
	,									

IV	SIGNIFICANCE OF RADICAL CHEMISTRY IN LIVING SYSTEM Radical production in environment, superoxide and peroxide, health impact, action of radicals, cell mutation, diseases caused by free radical, cancer, radical quencher, anti-oxidants, natural anti- oxidants like vegetables, beverages like tea and coffee, fruits.	15
	Radical destroying enzymes: superoxide dismutase, catalase, peroxidase, mechanism of action.	
Sugge	sted Readings:	
1.	Kaim W, Bioinorganic Chemistry, Vol 4, Brigitte Scwederski, Wiley, 1994.	
2.	2. Crichton R. H. Biological Inorganic Chemistry – An Introduction, Elsevier, 2008.	
3.	3. Berg J. M., Tymoczeko J. L., Stryer I. Biochemistry, W. H. Freeman, 2008.	
4.	4. Bertini, I., Gray, H. B., Lippard, S. J. and Valentine, J. S. (1994) <i>Bioinorganic Chemistry</i> . Universit Books (1994)	y Science
5.	5. Lippard S., Berg J. M. Principles of Bioinorganic Chemistry; University Science Books 1994.	
6.	6. Polymer science, V. R. Gowariker, N. V.Viswanathan, J. Sreedhar, New Age International.	

List of Skill Enhancement Courses

Sr. No.	Name of the course	Course Code	L/P	Т	P	Credits
1	Personality Development	SBS CH 0201 SE 2002	2	0	0	2
2	Computer Applications in Chemistry	SBS CH 0202 SE 2002	2	0	0	2
3	Science Communication and Popularization	SBS CH 0203 SE 2002	2	0	0	2
4	Biofertilizer	SBS CH 0204 SE 2002	2	0	0	2
5	Herbal Science & Technology	SBS CH 0205 SE 2002	2	0	0	2
6	Fermentation Science & Technology	SBS CH 0206 SE 2002	2	0	0	2
7	Environment Impact Analysis	SBS CH 0207 SE 2002	2	0	0	2

Course	e No:	: Course Name: Course Code:										
		Personality Develop	oment			SBS CH 02	08 SE 2002	2				
Batch	:	Programme:	Semester:	L	т	Р	Credits	Contact Hrs.				
2022		Integrated B.Sc					_	per Week:	02			
Onwai	rds	M.Sc. Chemistry	1/11	2	0	0	2	Total Hrs.:	30			
Total I	Evaluatio	n Marks: 50	Examinatio	n Duration:		2 Hrs.						
CIE:	15 Mar	KS	Pre-requisit	e of course:	Mental h	euristics, M	ental primi	ng, Checklists,	Stress			
TEE:	35 Marl	۲S	managemer	nt, Cognitive	biases, Le	eadership qu	ualities					
Course	2	Basic psychology sk	ills, productiv	ity and time	manager	nent, dealin	g negativit	y, critical think	king and			
Object	tives	human resources										
Course	e	After completing th	is course, stu	dent is expe	cted to le	arn the follo	wing:					
Outco	mes:	CO1: Develop unde	rstanding of t	the concepts	and prine	ciples of bas	ic psycholo	ogical skills				
		CO2: Apply techniq	ues and meth	nods to enha	nce produ	uctivity and	time mana	gement				
		CO3: Develop critic	al thinking sk	ills								
		CO4: Organize hum	an resources	with improv	ed leader	ship qualitie	25					
		CO5: Improve logic	al fallacies									
CO6: Overall personality development												
			C	OURSE SYLL	.ABUS							
NOTE:												
i) Que	stion no.	1 is compulsory and	to be set fror	n the entire	syllabus. I	t will have s	even sub-j	parts and stud	ents			
need t	o answer	any four. Each part	carries three	and half mar	ks.							
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will hav	ve three sub-p	arts and			
studer	its need t	to answer any two su	ib-parts of ea	ch question.	Each par	t carries sev	en marks.		Constant			
Unit				Conte	nts				Contact			
10.									ا ا ا ا			
•	Mental	Heuristics and Primi	ng. Cialdini's s	six psycholog	ical princ	iples. Charis	ma and ch	arisma	0			
	enhance	ements, facing interv	views									
II	PRODU	CTIVITY AND TIME N	IANAGEMEN	Т					8			
	Eisenho	wer Matrix, Pomodo	ro Technique	, Dealing wit	h Procras	tination, Jou	urnaling m	ethods,				
	Checklis	sts, to-do lists and scl	heduling the	events								
ш	DEALIN	G NEGATIVITY							7			
	Balance, stress management, coping with failures and depression											
IV	CRITICA	L THINKING AND HU	JMAN RESOU	IRCES					7			
	Logical f	allacies, Cognitive bi	ases, Mental	Models, Criti	cal Thinki	ng. Evaluati	on and imp	provement:				
	Leaders	hip qualities.		, -		5	I-	,				
		-										

- 1. Bast, F., Crux of time management for students (2016). Available at: https://www.ias.ac.in/article/fulltext/reso/021/01/0071-0088
- 2. Cialdini, R.B., Influence: The Psychology of Persuasion, Revised Edition. Harper Collius (2001).
- 3. Green, C.J.,Leadership and soft skills for students: Empowered to succeed in High School, College and beyond. Dog Ear Publishing (2015).
- 4. Velayudhan, A. and Amudhadevi, N. V., Personality Development for College Students. LAP Lambert Academic Publishing (2012).

Course	e No:	: Course Name: Course Code:										
		Computer Applicati	ons in Chemi	stry		SBS CH 02	09 SE 2002	2				
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact H	rs.			
2022		Integrated B.Sc						per Week	: 02			
Onwai	rds	M.Sc. Chemistry	1/11	2	0	0	2	Total Hrs.	: 30			
Total I	Evaluatio	n Marks: 50	Examinatio	n Duration:		2 Hrs.						
CIE:	15 Mar	<s< th=""><th>Pre-requisit</th><th>e of cour</th><th>se Snre</th><th>adsheet</th><th>Google</th><th>search S</th><th>ubscription</th></s<>	Pre-requisit	e of cour	se Snre	adsheet	Google	search S	ubscription			
TEE:	35 Marl	۲S	Bibliograph	y, MS office	, Image p	rocessing	doogie .	scarch, s				
Course	?	Spreadsheet Applic	ations, Intern	et Resources,	Bibliogra	ıphy manag	ement, Otl	her softwar	e resources			
Object	tives											
Course	9	After completing th	iis course, stu	dent is expe	cted to lea	arn the follo	wing:					
Outco	mes:	CO1: Apply the bas	ic operations	of spreadshe	et applica	ations	. .					
		CO2: Recognize adv	anced resour	ces for acces	sing scho	larly literati	ure from in	iternet				
		CO3: Utilize bibliog	rapny manago us software r	ement sortwites wit	are while h advance	typing and (and its on	ng citations	Institutos			
									ibstitutes			
COURSE SYLLABUS												
NOTE:												
i) Que	stion no.	1 is compulsory and	to be set fror	n the entire s	syllabus. I	t will have s	even sub-j	parts and st	udents			
need t	o answer	any four. Each part	carries three	and half mar	ks.							
ii) Que	stion nos	s. 2 to 5 are to be set	from all four	units one fro	om each. I	Every quest	ion will hav	ve three su	p-parts and			
studer	its need t	to answer any two su	ib-parts of ea	ch question.	Each part	carries sev	en marks.		Contest			
No				Conte	nts				Contact			
10.	SPREAD	SHEFT APPLICATION	IS						8			
	Introdu	ction of spreadshee	t (MS Excel),	application,	formula	s and functi	ions, perfo	orming basi	c			
	statistic	s using spreadsheet	t applications	, creating ba	asic grapł	ns using spr	eadsheet	0				
	applicat	ions, logical (Boolea	an) operators	5.								
II	INTERN	ET RESOURCES							8			
	Advanc	ed Google search op	perators and	Boolean fur	ictions, In	troduction	to Google	e Scholar				
	and acc	essing scholarly lite	rature from I	nternet, Fak	e News a	nd spotting	g the fake	news,				
	multim	edia resources and	podcasts, RSS	S/XML Feeds	and feed	d subscripti	on using a	feed				
	reader.											
111	BIBLIOG	IRAPHY MANAGEMI	ENT		· -				7			
	Introducing a bibliography management software (for e.g. Endnote), Styles and Templates,											
	Changir	ig the bibliography	v style as pe	r journal to	ormat, cit	ing while	typing in	the office				
11/	applicat	tion, downloading c	itations from	Google Sch	olar.							
IV	OTHER	SOFTWARE RESOUR	CES						/			
	Introdu	ction to advanced	tunctions of	MS Word a	nd its Op	en Office s	substitutes	s including				
	tracking	changes, inserting	page numbe	rs and autor	natic tab	e of conter	its, Google	e Docs and				
	Forms,	ivis Power point, M	icrophotogra	ipny and sca	ne calibra	nion with I	magel, dig	gitai image				
	process	ing (Paint.net or Gli	VIP).									

1. User manual and online user manual of respective soft wares for the most updated content

2. Published books are not recommended as versions keep on updating very frequently; therefore, it is not easy to follow.

Course	e No:	Course Name: Course Code:									
		Science Communica	ation and Pop	ularization	n SBS CH 02010 SE 2002						
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact Hrs.			
2022		Integrated B.Sc			-			per Week:	02		
Onwar	rds	M.Sc. Chemistry	1/11	2	0	0	2	Total Hrs.:	30		
Total E	Evaluatio	n Marks: 50	Examinatio	n Duration:		2 Hrs.					
CIE:	15 Mar	ks	Pre-reauisit	e of course:	Print scie	ence. Visual	media. In	ternet			
TEE:	35 Marl	<s< td=""><td>communica</td><td>tion, Blogs,</td><td>Outreach</td><td>n talks, Publ</td><td>ic sensitiz</td><th>ation</th><td></td></s<>	communica	tion, Blogs,	Outreach	n talks, Publ	ic sensitiz	ation			
Course Object	e tives	Print Science Com Communication, S	munication, \ cience Outre	/isual Media ach Talks an	a Science d Public S	Communica Sensitizatio	ation, Inte n	rnet Science			
Course Outco	CO1: Identify the need and role of science communication in human development CO2: utilize visual media science communication for creating scripts and documentaries CO3: Contribute in science popularization through internet communication and public sensitization										
	COURSE SYLLABUS										
i) Ques need t ii) Que studer	stion no. to answer estion nos	1 is compulsory and any four. Each part 5. 2 to 5 are to be set to answer any two su	to be set fron carries three from all four Ib-parts of ea	n the entire and half mar units one fro ch question.	syllabus. I ks. om each. Each part	t will have s Every quest t carries sev	even sub- ion will ha [,] en marks.	parts and stud ve three sub-p	lents parts and		
Unit No.			·	Conte	nts				Contact Hrs.		
1	PRINT S Need fo impact at natio case sto works o Riddley	CIENCE COMMUNIC or Science Journalism on technology. Role onal and internation udies of celebrated of Bill Bryson, Richam , importance for com	ATION m: Science ha of science ar nal levels. Wi works of scie d Dawkins, F mmunication	as potential nd technolog riting and co ence comm Richard Feyr through reg	for breal gy in hum ommunic unicators iman, Isaa gional lan	king news, i an develop ating popul including (ac Asimov, guages.	impact on ment. Frar lar articles Cosmos by Carl Zimm	Human life, ning policies s effectively, carl Sagan, er and Matt	8		
11	VISUAL MEDIA SCIENCE COMMUNICATION Advanced Google search operators and Boolean functions, Introduction to Google Scholar and accessing scholarly literature from Internet, Fake News and spotting the fake news, multimedia resources and podcasts. BSS/XML Feeds and feed subscription using a feed reader							8			
III	II INTERNET SCIENCE COMMUNICATION Science outreach through internet: Social media, Websites, Blogs, Youtube, Podcast etc.							7			
IV	V SCIENCE OUTREACH TALKS AND PUBLIC SENSITIZATION Tactics for providing a charismatic and effective public talk, use of metaphors, speaking in context, Science outreach for biodiversity conservation sensitization of public								7		

1. Selected works of Carl Sagan, works of Bill Bryson, Richard Dawkins, Richard Feynman, Isaac Asimov, Carl Zimmer and Matt Riddley.

2. Gigante, E. Marie (2018). Introducing Science Through Images: Cases of Visual Popularization (Studies in Rhetoric/Communication), University of South Carolina Press.

Batch: 2022	Biofertilizers Programme:				SBS CH 02	011 00 200				
Batch: 2022	Programme:	-	SBS CH 02011 SE 2002							
2022 Ontwo redo		Semester:	L	т	Р	Credits	Contact Hrs.			
	Integrated B.Sc						per Week:	02		
Unwards	M.Sc. Chemistry	1/11	2	0	0	2	Total Hrs.:	30		
Total Eval	luation Marks: 50	Examination	Duration:		2 Hrs.					
CIE: 15	5 Marks	Dro roquicit	o of courso	Licoful m	icrobos Cua	nobactoria	Mucorrhizo	Organic		
		farming Rec	e of course: sycling Vern	oserui m	tcrobes, Cya +	nobacteria	i, iviycorriiza,	Organic		
TEE: 35	Marks	ianning, Nec	yening, vern	incompos	L					
Course	Useful microbes, Cy	anobacteria,	Mycorrhiza,	Organic f	farming, Rec	cycling, Ver	micompost			
Objectives	s									
Course	After completing th	is course, stu	dent is expe	cted to le	arn the follo	wing:				
Outcomes	s: CO1: Develop their	understandin	g on the cor	ncept of b	io-fertilizer					
	CO2: Identify the di	fferent forms	of biofertili	zers and t	heir uses					
	CO3: Compose the	Green manuri	ing and orga	nic fertili	zers					
	CO4: Develop the integrated management for better crop production by using both nitrogenous									
and phosphate bio fertilizers										
		CC	OURSE SYL	LABUS						
NOTE:										
i) Question	n no. 1 is compulsory and	to be set from	n the entire	syllabus.	It will have s	even sub-j	parts and stud	ents		
need to ar	nswer any four. Each part	carries three a	and half ma	rks.						
ii) Questio	on nos. 2 to 5 are to be set	from all four	units one fr	om each.	Every quest	ion will hav	ve three sub-p	parts and		
students n	need to answer any two su	b-parts of eac	ch question	. Each par	t carries sev	en marks.				
Unit			Conte	ents				Contact		
No.								Hrs.		
I UN	NIT -1							8		
Ge	eneral account about	the microbe	s used as	s biofert	ilizer – Rł	nizobium	 isolation, 			
ide	entification, mass mul	tiplication,	carrier-bas	ed inocu	ulants, Act	inorrhizal	symbiosis.			
Az	cospirillum: isolation and	mass multipl	ication – ca	arrier-bas	ed inocular	t, associat	ive effect of			
dif	fferent microorganisms.	Azotobacter	: classifica	tion, cha	iracteristics	– crop i	response to			
Az	otobacter inoculum, mail	ntenance and	a mass mult	iplicatior	1.					
	NII -2							8		
Cy	anobacteria (blue green	algae), Azolia	a and Anab	aena azoi		tion, hitro	gen fixation,			
	ctors anecting growth, bi	ue green alga	ae and Azon	la in rice o	cultivation.			7		
	VII -3	where of my	corrhizal a	scociatio	n tavanan		conco and	/		
Nycorrnizal association, types of mycorrnizal association, taxonomy, occurrence and										
distribution, phosphorus nutrition, growth and yield – colonization of VAIVI – isolation and										
inoculum production of VAW, and its influence on growth and yield of crop plants.										
	vii -4 ganic farming - Groop	manuring an	d organic	fortilizor	Recycling	of his s	legradable	/		
	game farming - Green	Industrial	Nastos — h	iocompo	st making	nothods	types and			
	othod of vormicomposition		wasies – D lication	locompos	st making I	nethous,	types and			
		^g – neiu App								
NOTE: i) Question need to ar ii) Questio students n Unit No. I UN Ge ide Azd dif Azd II UN Cy fac III UN My dis inc IV UN	CO3: Compose the CO4: Develop the in and phosphate bio in and phosphate bio in on no. 1 is compulsory and nswer any four. Each part of on nos. 2 to 5 are to be set need to answer any two su NIT -1 eneral account about in entification, mass mult cospirillum: isolation and fferent microorganisms. cotobacter inoculum, main NIT -2 vanobacteria (blue green ctors affecting growth, bl NIT -3 ycorrhizal association, the stribution, phosphorus no oculum production of VAI NIT -4 rganic farming – Green unicipal, agricultural and	Green manuri ntegrated mar fertilizers CC to be set from carries three a from all four ib-parts of eac the microbe tiplication, mass multipl Azotobacter ntenance and algae), Azolla ue green alga cypes of my utrition, grow M, and its inf manuring and lindustrial w	DURSE SYL DURSE	Anic fertilizers ior better of LABUS syllabus. rks. om each. Each par ents biofert ed inocu arrier-bas tion, cha ciplication aena azol la in rice of ssociatio ld – color growth ar fertilizers iocompos	zers crop product It will have s Every quest t carries sev ilizer – Rh ulants, Act ed inoculan tracteristics n. Ilae associat cultivation. n, taxonon nization of id yield of c s, Recycling st making t	tion by usir seven sub- ion will haven marks. hizobium tinorrhizal t, associat – crop tion, nitrog tion, nitrog tion, nitrog tion, nitrog of bio- conto methods,	ag both nitrogen parts and stud ve three sub-p – isolation, symbiosis. tive effect of response to gen fixation, rence and lation and lation and lation and lation and	enous ents parts and Contact Hrs. 8 8 8 7 7		

1. Dubey, R.C. (2005). A Text book of Biotechnology S.Chand & Co, New Delhi.

2. John Jothi Prakash, E. (2004). Outlines of Plant Biotechnology. Emkay Publication, New Delhi.

3. Kumaresan, V.(2005). Biotechnology, Saras Publications, New Delhi.

4. NIIR Board. (2012). The complete Technology Book on Biofertilizer and organic farming. 2nd Edition. NIIR Project Consultancy Services.

5. Sathe, T.V. (2004) Vermiculture and Organic Farming. Daya publishers.

6. Subba Rao N.S. (2017). Biofertilizers in Agriculture and Forestry. Fourth Edition. Medtech.

7. Vayas, S.C, Vayas, S. and Modi, H.A. (1998). Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.

Course	e No:	Course Name: Course Code:										
		Herbal Science & Te	echnology		r	SBS CH 02	012 SE 200)2				
Batch:		Programme:	Semester:	L	т	Р	P Credits Contact Hr					
2022		Integrated B.Sc					-	per Week:	02			
Onwar	ds	M.Sc. Chemistry	1/11	2	0	0	2	Total Hrs.:	30			
Total E	valuatio	n Marks: 50	Examinatio	Duration:		2 Hrs.						
CIE:	15 Marl	ks	Pre-requisit Pharmacogr	e of course: losy, Adulter	Herbal mo ation, Sec	edicines, Pla condary met	int product abolites	ts, Biopesticid	es,			
TEE.		Norhal medicines	lant products	Bionesticid	oc Dharm		Aultoratio	n Secondary				
Object	ives	metabolites		, biopesticiu	es, Filain	lacognosy, /	Auditeratio	Jii, Secondary				
Course	 CO1: Develop their understanding on Herbal Technology CO2: Define and describe the principle of cultivation of herbal products. CO3: List the major herbs, their botanical name and chemical constituents. CO4: Evaluate the drug adulteration through the biological testing CO5: Formulate the value-added processing / storage / quality control for the better use of her medicine CO6: Develop the skills for cultivation of plants and their value-added processing / storage / quality control 											
			C	OURSE SYLL	ABUS							
NOTE: i) Ques need t ii) Que studen	stion no. o answer stion nos	1 is compulsory and any four. Each part 5. 2 to 5 are to be set to answer any two su	to be set fror carries three from all four ıb-parts of ea	n the entire s and half mar units one fro ch question.	syllabus. I ks. om each. I Each part	t will have s Every questi : carries sev	even sub-r on will hav en marks.	parts and stud	lents parts and			
Unit		•		Conte	nts				Contact			
No.									Hrs.			
I	UNIT -1 Herbal Technology: Definition and scope; Herbal medicines: history and scope; Traditional systems of medicine, and overview of AYUSH (Traditional Indian Systems of Medicine); Cultivation - baryesting - processing - storage of berbs and berbal products								8			
II	UNIT -2		-						8			
	Value a as herba parts us	dded plant products al medicines, nutrac sed, major chemical	s: Herbs and euticals, cosr constituents	herbal produneticals and .	ucts reco biopestic	gnized in In cides, their I	dia; Majoı 3otanical r	r herbs used names, plant				
III	UNIT -3							7				
	Pharma the foll <i>roseus,</i> (Tinosp	cognosy - Systemat owing herbs: Tulsi, <i>Withania somnife</i> ora), Saravar. Herba	ic position, b Ginger, Curc era, Centella Il foods, futu	otany of the cuma, Fenug a asiatica, re of pharma	e plant pa greek, Inc <i>Achyran</i> acognosy	art used and dian Goose thes asper	d active pr berry <i>, Cat</i> ca, Kalme	inciples of <i>charanthus</i> egh, Giloe				

IV	UNIT -4 Analytical pharmacognosy: Morphological and microscopic examination of herbs, Evaluation of drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds). Plant gene banks, Cultivation of Plants and their value- added processing / storage / quality control for use in herbal formulations, Introductory knowledge of Tissue culture and Micro propagation. of some medicinal plants (Withania somnifera, neem and tulsi),
Sugge	ested Readings:
1. Ag	arwal, P., Shashi, Alok., Fatima, A. and Verma, A. (2013). Current scenario of Herbal Technology
world	dwide: An overview. Int J Pharm Sci Res; 4(11): 4105-17.
2. Arl	per, Agnes. (1999). Herbal Plants and Drugs. Mangal Deep Publications, Jaipur.
3. Va	rzakas, T., Zakynthinos, G, and Francis Verpoort, F. (2016). Plant Food Residues as a Source of
Nutra	aceuticals and Functional Foods. Foods 5: 88.
4. Ab	urjai, T. and Natsheh, F.M. (2003). Plants Used in Cosmetics. Phytotherapy Research 17 :987-1000.
5. Pa [:]	tri, F. and Silano, V. (2002). Plants in cosmetics: Plants and plant preparations used as ingredients for
cosm	etic products - Volume 1. ISBN 978-92-871-8474-0, pp 218.
6. AY	USH (www.indianmedicine.nic.in). About the systems—An overview of Ayurveda, Yoga and Naturopathy,
Unan	i, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha
and F	Iomoeopathy (AYUSH), Ministry and Family Welfare, Government of India.
7. Eva	ans, W.C. (2009): Trease and Evans PHARMACOGNOSY. 16th Edition, SAUNDERS / Elsevier.
8. Siv	arajan, V.V. and India, B. (1994). Ayurvedic Drugs and Their Plant Sources. Oxford & IBH Publishing
Comp	Dany, 1994 - Herbs - 570 pages.
9. Mi	ller, L. and Miller, B. (2017). Ayurveda & Aromatherapy: The Earth Essential Guide to Ancient Wisdom
and N	Modern Healing. Motilal Banarsidass,; Fourth edition .
10. K	okate, C.K. (2003). Practical Pharmacognosy. Vallabh Prakashan, Pune.

Course	e No:	Course Name:				Course Code:					
		Fermentation Scien	ce & Technol	ogy		SBS CH 02	013 SE 200	2			
Batch:		Programme:	Semester:	L	т	Р	Credits	Contact Hrs			
2022		Integrated B.Sc	_	-				per Week:	02		
Onwai	rds	M.Sc. Chemistry	1/11	2	0	0	2	Total Hrs.:	30		
Total I	Evaluatio	n Marks: 50	Examinatio	n Duration:		2 Hrs.					
CIE:	15 Marl	٢S	Pre-requisit	e of course:	Microbia	l culture, Fe	ermentatio	on, Metabolit	es,		
TEE:	35 Marl	<s< td=""><td colspan="8">Fermented products, Enzyme production, Bioproduct recovery</td></s<>	Fermented products, Enzyme production, Bioproduct recovery								
Course	2	Microbial culture,	Fermentatio	n, Metabolit	es, Ferme	ented produ	ucts, Enzyr	ne productio	n,		
Object	tives	Bioproduct recove	ry								
Course	e	After completing th	is course, stu	dent is exped	ted to lea	arn the follo	wing:				
Outcomes: CO1: Employ the process for maintenance and preservation of microorganisms											
CO2: Analyze the various aspects of the fermentation technology and apply for Fermenta							ntative				
		production									
		CO3: Demonstrate	proficiency	in the experi	mental te	echniques f	or microbi	al production	n of		
		enzymes: amylase	and protease	e, bio produ	ct recove	r					
			C	OURSE SYLL	ABUS						
NOTE:											
i) Que	stion no.	1 is compulsory and	to be set fror	n the entire s	syllabus. I	t will have s	even sub-p	parts and stud	lents		
need t	o answer	any four. Each part	carries three	and half mar	ks.						
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every questi	on will hav	/e three sub-p	parts and		
studer	nts need t	o answer any two su	ib-parts of ea	ch question.	Each part	carries sev	en marks.				
Unit				Contei	nts				Contact		
NO.									Hrs.		
1	UNII -1	tion of microbiol ou	ltura Draman	ation and at	viliantion	offormon	ation mon	lia kalatian	8		
	and imp	provement of indust	rially import	ation and ste ant microorg	ganisms.	l of terment	ation med	lia. Isolation			
11	UNIT -2		1 1		,				8		
	Mainte	nance and preserva	tion of micro	organisms, l	Metaboli	c regulatior	ns and ove	rproduction			
	of meta	bolites. Kinetics of	microbial gro	wth and pro	duct forr	nation.					
III	UNIT -3		-	-					7		
	Scope a	nd opportunities of	fermentatio	n technolog	y. Princip	les of ferm	entation:	Submerged,			
solid state, batch, fed-batch and continuous culture. Fermentative production of vinegar,											
alcohol (ethanol, wine, beer), acids (citric acid and gluconic acid), amino acids (lysine and											
	glutami	c acid) and antibiot	cs (penicillin	and strepto	mycin).						
IV	UNIT -4										
	Microbi	al production of en	zymes: Amyla	ase and Prot	ease. Bio	product red	covery.				

1. Waites M.J. (2008). Industrial Microbiology: An Introduction, 7th Edition, Blackwell Science, London, UK.

2. Prescott S.C., Dunn C.G., Reed G. (1982). Prescott & Dunn's Industrial Microbiology, 4th Edition, AVI Pub. Co., USA.

3. Reed G. (2004). Prescott & Dunn's industrial microbiology, 4th Edition, AVI Pub. Co., USA.

4. JR Casida L.E. (2015). Industrial Microbiology, 3rd Edition, New Age International (P) Limited Publishers, New Delhi, India.

5. Waites M.J., Morgan N.L., Rockey J.S. and Higton G. (2001) Industrial Microbiology: An Introduction. 1st Edition, Blackwell Science, London, UK.

6. Pelczar M.J., Chan E.C.S. and Krieg N.R. (2003) Microbiology. 5th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Course	e No:	Course Name:	t Analysis			Course Code:					
Batch		Programme.	Semester	I	т		Cradite	Contact Hrs			
2022		Integrated B Sc -	Semester.	L		r i	creuits	ner Week:	02		
Onwar	rds	M.Sc. Chemistry	1/11	2	0	0	2	Total Hrs.:	30		
Total E	Evaluatio	n Marks: 50				-					
			Examinatio	n Duration:		2 Hrs.					
CIE:	15 Marl	ks			mont Fr	vironnonto	limporto	coccert D	reject		
			Environmer	ital manage	ment, En	vironmenta	ii impact a	issessment, P	roject		
TEE:	35 Marl	<s< td=""><td>proponent,</td><th>Consultant,</th><td>Environi</td><td>nentai auui</td><td>l, RISK dSS</td><th>essment, Leg</th><th>ISIALION</th></s<>	proponent,	Consultant,	Environi	nentai auui	l, RISK dSS	essment, Leg	ISIALION		
Course	2	Environmental ma	nagement, E	nvironment	al impact	assessmen	t, Project	proponent,			
Object	tives	Consultant, Enviro	nmental aud	it, Risk asse	ssment, L	egislation					
Course	9	After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:				
Outco	Outcomes: CO1: Have critical understanding of environmental impact										
	CO2: Learn important steps of EIA process										
	CO3: Interpret the environmental appraisal and procedures in India.										
			C	OURSE SYL	ABUS						
NOTE:											
i) Ques	stion no.	1 is compulsory and	to be set from	n the entire	syllabus. I	t will have s	even sub-j	parts and stud	lents		
need t	o answer	any four. Each part	carries three	and half mai	rks.	-					
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fr	om each.	Every quest	ion will hav	ve three sub-p	parts and		
studer	its need t	to answer any two su	ib-parts of ea	cn question.	Each par	t carries sev	en marks.		Contact		
No				conte	nts				Hrs		
100.	ORIGIN		r						8		
•	Purpose	and aim. core valu	es and princi	ples. Histor	v of EIA d	evelopmen	t. Environi	mental	0		
	Manage	ement Plan, Environ	mental Impa	ct Statemer	t, Scope	of EIA in Pro	oject planı	ning and			
	Implem	entation.	·		, 1		, ,	0			
II	EIA PRO	CESS							8		
	Compoi	nents of EIA, EIA Me	thodology- S	creening, Sc	oping, Ba	seline data	, Impact Id	lentification,			
	Predicti	on, Evaluation and	Mitigation,	Appendices	and Form	ms of Appli	cation, Te	chniques of			
	Assessn	nent-Cost-benefit A	nalysis, Mat	rices, Chec	klist, Ove	erlays, Impa	act on En	vironmental			
	compor	nent: air, noise, wate	er, land, biolo	gical, social	and envi	ronmental f	actors. El	A Document.			
III	MAIN P	ARTICIPANTS IN EIA	PROCESS						7		
	Role of	Project proponent	t, environme	ental consu	tant, PCI	Bs, PCCs, p	ublic and	IAA. Public			
	particip	ation.									
IV	ENVIRO	NMENTAL APPRAIS	AL AND PROC	EDURES IN I		D EIA					
	Method	lology, indicators a	and mitigatio	on, Environ	mental A	udit of dif	ferent en	vironmental			
	resourc	es, Risk Analysis, St	rategic envir	onmental a	ssessmer	nt, ecologic	al impact	assessment:			
	legislati	on.	-			-	-				
	legislati	on.									

PRACTICAL

1. Prepare a Matrix of every environmental existing resource of your college or your hostel/mohalla or any defined area and evaluate each component using established methods and make audit analysis

2. Prepare a case report of Environmental impact of any area under development

Suggested Readings:

1. Kulkarni V and Ramachandra TV, (2006). Environmental Management, Capital Pub. Co. New Delhi.

2. Petts, J. (2005) Handbook of Environmental Impact Assessment- Volume 1 and 2. Blackwell Publishers, UK.

3. Glasson, J. Therivel, R. and Chadwick, (2006) A. Introduction to Environmental Impact Assessment. Routledge, London.

4. Canter, W. L. (1995) Environmental Impact Assessment, McGraw-Hill Science/ Engineering/ Math, New York;

Morris, P. and Therivel, R. (1995) Methods of Environmental Impact Assessment, UCL Press, London;
 Petts, J. (1999) (ed) Handbook of Environmental Impact Assessment, volume 1 and 2, Blackwell Science, Oxford;

7. Therivel, R. and Partidario, M. R. (1996) (eds) The Practice of Strategic Environmental Assessment, Earthscan, London;

8. Vanclay, F. and Bronstein, D. A. (1995) (eds) Environmental and Social Impact Assessment, Wiley & Sons, Chichester

Sr. No.	Name of the Course	Course Code	L	Т	Р	Credits
1	Medicinal Chemistry	SBS CH 0201 DSE 3104	3	1	0	4
2	Medicinal Chemistry Practical	SBS CH 0202 DSE 0042	0	0	4	2
3	Electrochemistry	SBS CH 0203 DSE 3104	3	1	0	4
4	Electrochemistry Practical	SBS CH 0204 DSE 0042	0	0	4	2
5	Advanced Material Chemistry	SBS CH 0205 DSE 3104	3	1	0	4
6	Material Chemistry Practical	SBS CH 0206 DSE 0042	0	0	4	2
7	Advanced Analytical Chemistry	SBS CH 0207 DSE 3104	3	1	0	4
8	Analytical Chemistry Practical	SBS CH 0208 DSE 0042	0	0	4	2
9	Organic Spectroscopy	SBS CH 0209 DSE 3104	3	1	0	4
10	Organic Spectroscopy Practical	SBS CH 0210 DSE 0042	0	0	4	2
11	Heterocyclic Chemistry	SBS CH 0211 DSE 3104	3	1	0	4
12	Heterocyclic Chemistry Practical	SBS CH 0212 DSE 0042	0	0	4	2
13	Organometallics and Bioinorganic Chemistry	SBS CH 0213 DSE 3104	3	1	0	4
14	Organometallics and Bioinorganic Chemistry Practical	SBS CH 0214 DSE 0042	0	0	4	2
15	Introduction to Nanochemistry & Applications	SBS CH 0215 DSE 3104	3	1	0	4
16	Nanochemistry Practical	SBS CH 0216 DSE 0042	0	0	4	2

List of Discipline Specific Elective Courses

Course	e No:	Course Name:				Course Code:				
		Medicinal Chemistr	y		_	SBS CH 02	01 DSE 310)4		
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact Hrs		
2022	e al a	Integrated B.Sc	<u> </u>	2				per Week:	04	
Unwar		wi.sc. Chemistry	V/VI	3	1	0	4	Total Hrs.:	60	
Total I	zvaluatio	n Marks: 100	Examinatio	n Duration:		3 Hrs.				
CIE:	30 Mar	ks	Pre-requisit	e of course	: The ba	asics of m	edicinal o	hemistry, bi	ophysical	
TEE:	70 Marl	<s< th=""><th>angle and d</th><th>lihydral angl ith example</th><th>e, Concel s</th><th>pt of stered</th><th>ichemistry</th><th>in terms of</th><th>gtn, bond biological</th></s<>	angle and d	lihydral angl ith example	e, Concel s	pt of stered	ichemistry	in terms of	gtn, bond biological	
Course	>	The basics of med	icinal chemis	stry, biophys	- sical prop	erties. Und	lerstandin	g of the 3D-9	structure	
Obiect	tives	along with bond le	ngth bond a	ngle and dib	vdral ang	de Concent	t of stereo	chemistry in	terms of	
		biological response	e with examp	oles	yararang					
Course	9	After completing th	iis course, stu	dent is expe	cted to lea	arn the follo	wing:			
Outco	mes:	CO1: The basics of	medicinal che	mistry, biopl	nysical pro	operties				
CO2: Biological activity parameters										
		CO3: Drug metabol	ism							
	CO4: Biophysical and chemical properties of enzymes, normones, vitamins									
		COS: Concept of rai	cional drug de	esign	ofmodici		nda			
	COB: synthesis, preparation and purification of medicinal compounds									
			C	OURSE SYLL	ABUS					
NOTE:										
i) Que	stion no.	1 is compulsory and	to be set from	n the entire	syllabus. I	t will have s	even sub-j	parts and stud	lents	
need t	o answer	any four. Each part	carries three	and half mar	ks.	_				
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will ha	ve three sub-j	parts and	
studer	its need i	to answer any two st	ib-parts of ea	ch question.	Each part	carries sev	en marks.		Contort	
Unit No.				Conte	nts				Contact Hrs.	
1	BIO-PH	SICOCHEMICAL PRO	PERTIES						15	
-	Acidity/	Basicity, Solubility,	lonization. Hy	/drophobic r	properties	s. Hvdrophi	lic propert	ies. Lipinski	_0	
	Rule. D	rug-like properties.	Understandi	ng of the big	ological a	ctivity para	meters su	ch as Ki. Kd.		
	LD50, EC	C50, IC50, CC50, ADME	T properties			••••••, para				
II	STRUCT	URAL PROPERTIES A	ND DRUG TA	RGET UNDE	RSTANDI	NG			15	
	Isosteri	sm, Bioisosterism,	Nonclassical	isosteres, L	Inderstar	nding of th	e 3D-stru	cture along		
	with bo	nd length, bond ang	gle and dihyd	ral angle, Co	ncept of	Configurati	on and Co	onformation		
	with ex	amples, Concept of	f stereochem	nistry in terr	ns of bio	logical resp	onse with	n examples,		
	Stereos	elective receptors	or enzymes	such as mu	scarinic r	receptor, St	tereochen	nically pure		
	drug and recemates, Examples such as catecholamines, etc.									
	Metabolism, Drug metabolism, Anti-metabolite, Enzyme inhibitor, Agonist, Antagonist,									
	Exampl	es.								
III	III MEDICINAL CHEMISTRY OF THERAPEUTIC AGENT									
	Structu	re, Chemistry, Mod	e of action a	nd adverse	effect of	the repres	entative t	herapeutic		
	agents	such as Anti-infecti	ve agent, An	itimalarials,	Antibacte	erial, Antivi	ral, Antica	ancer, CNS		
	acting c	lrugs, Adrenergic Aန	gents, Choline	ergic Drugs,	Diuretics	, Cardivasco	ular, local	anesthetic		
	agent, A	Analgesic Agents, Hi	stamine and	Antihistami	ne agents	5				

IV	STEROIDS, PROSTAGLANDINS, ENZYME, HORMONE AND VITAMINS, RATIONAL DRUG DESIGN	15								
	Biophysico-chemical properties, Steroid Hormone Receptors, Chemical Contraceptive agents, COX-2 inhibitors, Prostaglandins for Ophthalmic use, pharmaceutically important enzyme products such as Pancreatin, Trypsin, Insulin. Classification of vitamins with examples.									
	Structure activity relationship, Drug-receptor understanding, Molecular modeling, Structure based drug design. QSAR.									
Sugge	Suggested Readings:									
1.	Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical by Charles Owens V	Vilson,								
	John H. Block, Ole Gisvold, John Marlowe Beale									
2.	oye's Principles of Medicinal Chemistry by David A. Williams, Thomas L. Lemke, William O. Foye									
	(2008), Kluwer publication.									
3.	Remington: The Science and Practice of Pharmacy Vol 1, Ed. 19 by Joseph Price Remington, Al Gennaro. (1995), MACK Publishing.	fonso R.								
4.	Burgers Medicinal Chemistry by Manfred E. Wolff, Alfred Burger									
5.	Burgers Medicinal Chemistry and Drug Discovery by Abraham D. J., Lewis F. L., Burger A., vol.5 Edn., 2003, Hoboken N.J.Wiley,	, 6 th								
6.	The Organic Chemistry of Drug Design and Drug Action by Silverman R. B., 2nd Edn., Academic 2012.	Press.								
7.	Exploring QSAR: Fundamental and applications in Chemistry and Biology by Hansch C. and Leo American Chemical Society (1995)	<i>),</i> А								
8.	Patrick, G. Medicinal Chemistry, Oxford.University Press (2000)									

Course No:	Course Name: Medicinal Chemistr	Course Name:Course Code:Medicinal Chemistry PracticalSBS CH 0202 DSE 0						
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact Hrs	s.
2022	Integrated B.Sc						per Week:	04
onwards	M.Sc. Chemistry	V/VI	0	0	4	2	Total Hrs.:	60
Total Evalu	ation Marks: 50	Examinatio	n Duration:	6 Hrs.	1			
CIE: 15 M	Aarks Aarks	Pre-requisit properties, angle and c	e of cours Understand lihydral ang	se: The b ing of the le, Concer	asics of m 3D-structur ot of stereo	edicinal c e along w chemistry	hemistry, bi ith bond leng in terms of	iophysical gth, bond biological
		response wi	th example	S.		-		_
Course Objective	The basics of medic with bond length, b response with exan	inal chemistr ond angle an pples	y, biophysic d dihydral c	al properti Ingle, Conc	es, Understo cept of stere	anding of t ochemistry	the 3D-struct y in terms of I	ure along: biological
Course Outcomes:	After completing the CO1: The basics of a CO2: Biological acti CO3: Drug metabol CO4: Biophysical ar CO5: Concept of rat CO6: Synthesis, pre	is course, stu medicinal che vity paramete ism Id chemical p cional drug de paration and	dent is expe mistry, biop ers roperties of esign purificatior	ected to le ohysical pr enzymes, of medici	arn the follo operties hormones, v nal compou	owing: vitamins nds		
		(OURSE SYL	LABUS				
NOTE:	ons will be set, one from	each of the I	INIT The ca	undidates a	re required	to attemn	t all the ques	stions
Unit No.			Content	s	ire required	to attemp		Contact
onit no.			content					Hrs.
1	PURIFICATION AND PR	EPARATION						30
	1.Purification Techniqu	es of Solvents	s by Fraction	hal Distillat	ion and Vac	uum Distil	lation	
	2. Inin Layer Chromato	grapny Techn	Ique and Pu	rification (of commerci	ally avalla	ble	
	3 Prenaration of Acid/I	Pounds by Co Rasic Salts of	Drugs and F	valuation	ny. Af their Phys	sicochemic	al	
	Properties (Benzilic Aci	d & Sodium I	Benzoate)	valuation		bicochernit	.01	
			Jenzoute,					
	SYNTHESIS AND COMP	UTATIONAL	MODFLING					30
	Synthesis & Purification	of following	Compound	s using:				
	(i)Precipitation or Recry	stallization.	•	0				
	(ii)Synthesis of Benzimi	dazole.						
	(iii)Synthesis of Anthran	nilic Acid.						
	(iv)Synthesis of Sulphar	ilamide.						
	(v)Synthesis of benzoic	acid from be	nzyl alcohol					
	(vi)Synthesis of 1,4 – di	hydropyridin	2.					
	Computational modelir students.	ig of drug des	sign/use of s	oftwares r	nay be dem	onstrated	to	

- 1. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J. D. Barnes, M. J. K Thomas, 6th Edition, Pearson's Education Ltd.
- 2. Advanced Practical Medicinal Chemistry, Ashutosh Kar, New Age International Ltd. (2004).
- 3. Vogel"s Textbook of Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P.W.G. Smith, A. R Tatchell, 5th edition (2008), Pearson's Education Ltd.

Course	e No:	Course Name:				Course Code:				
		Electrochemistry	[[1	SBS CH 02	03 DSE 310	04		
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact Hrs		
2022	de	Integrated B.Sc	$\chi \Lambda \mu$	2	1	0	1	per week:	<u> </u>	
	us Ivaluatio	n Marke: 100	V/ VI	5		0	4	Total Hrs.:	60	
TOtal	valuatio		Examinatio	n Duration:		3 Hrs.				
CIE:	30 Mar	ks	Pre-requisit	e of cours	e: Basic	understand	ding elect	rochemistry,	idea of	
TEE:	70 Mar	<s< td=""><td>electiochen</td><td>lical potentia</td><td>ai, kilowie</td><td>uge of elect</td><td>lioues.</td><td></td><th></th></s<>	electiochen	lical potentia	ai, kilowie	uge of elect	lioues.			
Course Basic principle of laws of electrochemistry, understanding about chemical cells and their fund Objectives understanding of potentiometric titrations and their applications.							unction,			
CourseAfter completing this course, student is expected to learn the following:Outcomes:CO1: Basic principle of laws of electrochemistry.CO2: Understanding about chemical cells and their functionCO3: Understanding about electrodes, EMF measurement.CO4: Understanding about potentiometric titrations and their applications.CO5: Designing electrochemical cell.CO6: Use of electrochemical cell for various electrochemical reactions.										
			C	OURSE SYLL	ABUS					
NOTE: i) Ques need t ii) Que	stion no. o answer stion nos	1 is compulsory and any four. Each part 2 to 5 are to be set	to be set fror carries three from all four	n the entire s and half mar units one fro	syllabus. I ks. om each. I Fach part	t will have s Every quest	even sub- ion will haven marks	parts and stuc	lents parts and	
Unit	its need			Conte	nts		ch marks.		Contact	
No.									Hrs.	
1	No. Hr I Unit-I 1! Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch law of independent migration of ions. Debye-Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules. Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric								15	
11	 of water (III) solubility and solubility product of sparingly soluble salts, (IV) conductometric titrations, and (v) hydrolysis constants of salts. Unit-II Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry. Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quipone-hydroguipone, glass and SbO/Sb2O3 electrodes. Concentration cells 									

		with and without transference, liquid junction potential; determination of activity coefficients	
		and transference numbers. Qualitative discussion of potentiometric titrations (acid-base,	
		redox, precipitation).	
I		ELECTROANALYTICAL METHODS	15
		Classification of electroanalytical methods, basic principle of pH metric, potentiometric and	
		conductometric titrations. Techniques used for the determination of equivalence points.	
		Techniques used for the determination of pKa values.	
I	V	ELECTRICAL & MAGNETIC PROPERTIES OF ATOMS AND MOLECULES	15
		Structure, Chemistry, Mode of action and adverse effect of the representative therapeutic	
		agents such as Anti-infective agent, Antimalarials, Antibacterial, Antiviral, Anticancer, CNS	
		acting drugs, Adrenergic Agents, Cholinergic Drugs, Diuretics, Cardivascular, local anesthetic	
		agent, Analgesic Agents, Histamine and Antihistamine agents	
	Sugge	sted Readings:	
	1.Atki	ns, P.W & Paula, J.D. Physical Chemistry, 10th Ed., Oxford University Press (2014).	
	2.Cast	ellan, G. W. Physical Chemistry 4th Ed., Narosa (2004).	
	3.Mor	timer, R. G. Physical Chemistry 3rd Ed., Elsevier: NOIDA, UP (2009).	
4	4.Barr	ow, G. M., Physical Chemistry 5th Ed., Tata McGraw Hill: New Delhi (2006).	
!	5.Enge	el, T. & Reid, P. Physical Chemistry 3rd Ed., Prentice-Hall (2012).	
(6.Rog	ers, D. W. Concise Physical Chemistry Wiley (2010).	
-	7.Silbe	ey, R. J.; Alberty, R. A. & Bawendi, M. G. Physical Chemistry 4th Ed., John Wiley & Sons, Inc. (200	5).

Course No:	Course Name: Course Code:								
	Electrochemistry P	ractical			SBS CH 02	04 DSE 004	42		
Batch:	Programme:	Semester:	L	т	Р	Credit	Contact Hrs.		
2022	Integrated B.Sc						per Week:	04	
onwards	M.Sc. Chemistry	V/VI	0	0	4	2	Total Hrs.:	60	
Total Evaluatio	on Marks: 50	Examinatio	n Duration:	6 Hrs.					
CIE: 15 Mar	ks	Pre-requisit	e of cours	se: Basic	understand	ling elect	rochemistry,	idea of	
TEE: 35 Mar	ks	electrochem	nical potenti	al, knowle	dge of elect	rodes.			
Course	Basic principle of la	ws of electro	chemistry, u	inderstand	ing about c	hemical ce	lls and their fu	nction,	
Objectives	understanding of p	otentiometric	titrations a	nd their a	oplications.				
Course	After completing th	nis course, stu	dent is expe	ected to lea	arn the follo	wing:			
Outcomes:	CO1: Basic principle	e of laws of el	ectrochemi	stry.					
CO2: Understanding about chemical cells and their function									
	CO3: Understandin	g about elect	rodes, EMF	measurem	ent.				
	CO4: Understandin	g about poter	ntiometric ti	trations ar	nd their app	lications.			
	CO5: Designing electrochemical cell.								
	CO6: Use of electrochemical cell for various electrochemical reactions.								
		C	COURSE SYL	LABUS					
NOTE:									
I wo questions	will be set, one from	each of the U	JNII. The ca	ndidates a	re required	to attemp	t all the questi	ons.	
Unit No.			Content	S			Ľ		
			ΟΝSTANT					30	
	Determination of nH	of a given sol	ution using	olass electi	ode			50	
2.	Determination of cel	l constant.			oue.				
3.	Determination of eq	uivalent cond	uctance, de	gree of dis	sociation, a	nd dissocia	ation		
со	nstant of weak acid.		,		,				
II CO	NDUCTOMETRIC AN	ID POTENTIO	METRIC TIT	RATION				30	
1.	Conductometric titra	tion: strong a	icid vs. stror	ng base, we	eak acid vs.	strong bas	e.		
2.	Potentiometric titra	tion: strong	acid vs. sti	rong base	weak acic	<i>vs</i> . stror	ng base,		
po	tassium dichromate	vs. mohr's sal	t.						
Suggested Rea	dings:		D					(2011)	
I. Knosia,	, B. D.; Garg, V. C. & C	Julati, A. Seni	or Practical	Physical Cl	nemistry, R.		CO.: New Deini	(2011).	
Z. Aniuwa	alla, V.K. & Aggarwal, d. C. M. Miblor, I. M	R. Comprene	or D D Eve	cal Organi	in Dhysical	, Universit Chomistry	es Press.		
5. Gariano Now Ve	iand, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill:								
4 Halper	$n \land M \& McRane$	G C Exnerin	nental Physi	cal Chemis	strv 3 rd Fd ·	WH Free	man & Co · N	ew York	
(2003).		C. C. Experim	i ciitai i iiyoi						

Course	e No:	Course Name:				Course Code:					
		Advanced Materials	s Chemistry		-	SBS CH 02	05 DSE 310)4			
Batch:		Programme:	Semester:	L	I	Р	Credits	Contact Hrs	. 04		
2022 Onwar	rds	M Sc Chemistry	V/VI	3	1	0	4	Total Hrs	60		
Total F	valuatio	n Marks: 100	•/•	5	-	U	-	Totarms	00		
. otar i	_ valuatio		Examinatio	n Duration:		3 Hrs.					
CIE:	30 Mar	ks	Pre-requisit	e of course:	Idea of si	ngle crystal	s and X-ra	y diffraction,	synthesis		
			of nanoma	iterials and	their o	characteriza	tion, kno	wledge of	different		
TEE:	70 Marl	<s< td=""><td>microscopie</td><td>S.</td><td></td><td></td><td></td><td></td><td></td></s<>	microscopie	S.							
Course	?	Introduction of Gro	wth of single	e crystals, Cr	ystal stru	cture deter	mination k	by X-ray diffra	iction, d-		
Object	lives	Spacing formula,	synthesis of	VPD of non	and na omatoria	inotubes b Is Electron	y CVD al	NG IVIOCVD			
		and FDX) of nanom	aterials Scan	ning nrohe n	nicroscon	v Riodegrad	linci oscor Jahle polvr	ners	, ההובועו		
Course	2	After completing th	is course. stu	dent is expe	cted to lea	arn the follo	wing:	ners.			
Outco	mes:	CO1: Advanced idea	a of X-ray diff	raction			0				
		CO2: Structure solu	tion by X-ray	diffraction							
		CO3: Synthesis and	characterizat	ion of nanor	naterials						
	CO4: Use of nanomaterials in magnetism										
	CO5: Knowledge of various types of polymers										
	CO6: Idea of biodegradable polymers										
			C	OURSE SYLL	ABUS						
NOTE:											
i) Que	stion no.	1 is compulsory and	to be set fror	n the entire	syllabus. I	t will have s	even sub-j	parts and stud	lents		
need t	o answer	any four. Each part	carries three	and half mar	KS.			a three such a	a a utra la ja al		
studer	its need t	o answer any two su	if official four	ch question.	Each part	Every quest	ion will hav en marks.	ve three sub-p	barts and		
Unit		<u> </u>		Conte	nts				Contact		
No.									Hrs.		
I	CRYSTA	L STRUCTURE OF SO	LIDS						15		
	Fundam	nental of lattices, un	it cell, atomi	c coordinate	es, Bravai	s lattices, c	rystal dire	ction and			
	planes,	types of close packi	ng, packing e	efficiency, ra	dius ratio	os; few imp	ortant crys	stal			
	structu	res.									
	Synthes	sis of Inorganic solid	s; solid state	, solution pr	lase and v	apor phase	e synthesis	5;			
	Crystal	ation, nydrotnerma	i, soi-gei, sur	ractant-base	ed synthe	sis. Growtr	i of single	crystals.			
	roflocti	Structure determine	Cottoring of		, u-spacin	ng lonnula,	al Singlo	crystal and			
	nowder	diffraction Flectro	n and neutro	n diffractio	n Conce	nt of recipi	an Single rocal lattic	ci ystar and			
	microso	copy techniques.									
11	NANON	1ATERIAL FUNDAME	NTALS						15		
	Synthesis: Bottom-up vs. Top-down Methods. Solution phase synthetic methods. Role of										
	surfactant in shape and size control of nanomaterials. Synthesis of nanowires and nanotubes										
	by CVD and MOCVD method.										
	Nanom	aterials Characteriza	ation: XRD of	nanomater	ials, Elect	ron microso	copy (SEM	, TEM,			
	HRTEM	and EDX) of nanom	aterials, Scar	ning probe	microsco	py.	- f				
	Nanom	aterial properties	and appli	cations: N	lagnetic	properties	s of na	noparticles;			

	superparamagnetism, ferromagnetism in antiferromagnetic nanoparticles and single domain	
	to multidomain transition. magnetic nanoparticles as MRI contrast agents.	
III	POLYMER SCIENCE AND TECHNOLOGY	15
	Conducting polymers: basic principles of conducting polymers, delocalized electronic states	
	of conjugated polymers, polyanilines, polyacetylenes, polythiophene, applications of conducting polymers.	
	Rubber: Compounding and elastomeric properties, vulcanization, reinforcement.	
IV	BIODEGRADABLE POLYMERS	15
	Biodegradable polymers: Definition classification of natural biodegradable polymers, cellulose, cellulose acetate, cellophane, soy protein, corn, zein protein, wheat gluten protein, synthetic biodegradable polymers, polyhydroxy alkanoates, polycarpolactone, poly(vinyl alcohol), polyacetic acid, application of biodegradable and biomedical polymers, contact lens, dental polymers, artificial heart, kidney, skin, and blood cells. Fibers: natural fibers, cotton, wool, silk, rayon, artificial fibers, polyamides, acrylic acid, PVC, PVA.	
Sugge	ested Readings:	
1. Zhe	n Guo and Li Tan, Fundamentals and Applications of Nanomaterials.2009, Artech House, London	ı
Public	cation.	
2. Phy	vsical methods for chemistry: R. S. Drago, 1992, Saunders college publication.	
3. Pol [.] 4. P. J	ymer science, V. R. Gowariker, N. V.Viswanathan, J. Sreedhar, New Age International (P) Ltd., 20: . Flory, Principle of polymer chemistry, Cornell University Press.	15.
5. Pol [.] 6. V. 0	ymer Science and technology, Plastics, Rubber and composites, P. Ghosh, Tata McGraw Hill. Gowriker, N. V. Viswanathan, J. Sreedhar, Polymer Science, New Age Int.Publication, 2019.	

Course No:	o: Course Name:				Course Code:				
	Materials Chemistr	y Practical			SBS CH 0206 DSE 0042				
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact Hrs	•	
2022	Integrated B.Sc						per Week:	04	
onwards	M.Sc. Chemistry	V/VI	0	0	4	2	Total Hrs.:	60	
Total Evaluation Marks: 50		Examination Duration: 6 Hrs.							
CIE: 15 Marks		Pre-requisite of course: Idea of single crystals and X-ray diffraction, synthesis							
		of nanomaterials and their characterization, knowledge of different							
TEE: 35 I	Marks	microscopie	es.						
Course	Introduction of Growth of single crystals, Crystal structure determination by X-ray diffraction, d						iction, d-		
Objectives	Dbjectives spacing formula, Synthesis of nanowires and nanotubes by CVD and MOCVD method						method,		
	Nanomaterials Characterization: XRD of nanomaterials, Electron microscopy (SEM, TEM, HRTI						, HRIEM		
Course	and EDX) of nanomaterials, Scanning probe microscopy, Biodegradable polymers.								
Course Outcomes:	After completing this course, student is expected to learn the following:								
Outcomes.	S. COI: Advanced ridea of X-ray diffraction								
	CO2. Surthesis and characterization of panomatorials								
	CO1 : Use of papematerials in magneticm								
	COE: Knowledge of various types of polymers								
	COS: Knowledge of various types of polymers								
			COURSE SYL	LABUS					
NOTE.									
Two questi	ons will be set, one from	each of the l	JNIT. The ca	ndidates a	re required	to attemp	t all the quest	tions.	
Unit No.		Contents						Contact	
								Hrs.	
I	REPARATION OF NANOMATERIALS AND POLYMERS						30		
	1. Preparation of gold	1. Preparation of gold and silver nano-particles.							
	2. Interfacial polymerization, preparation of polyester from isophthaloyl chloride								
	(IPC) and phenolphthalein								
	X-RAY DIFFRACTION AI	ND CHARACT	ERIZATION	OF NANOI	MATERIALS			30	
	1. Analysis of XRD pattern of few selected crystals like NaNO ₃ , CaCl ₂ , etc.; Indexing of a						exing of a		
	given powder diffraction pattern of a cubic crystalline system.						_		
	2. Interpretation of FTI	R, NMR and U	IV-Vis data d	of given ma	aterial.				
	3. Estimation of particle	e size from th	e BET, SEM	technique	S.				
Suggested Readings:									
1. Fahlman, B.D. Materials Chemistry, Springer, 2004.									
2. P. J. Flory, Principle of polymer chemistry, Cornell University Press.									
3. Polymer Science and technology, Plastics, Rubber and composites, P. Ghosh, Tata McGraw Hill.									
4. V.C	4. V. Gowriker, N. V. Viswanathan, J. Sreedhar, Polymer Science. New Age Int. Publication. 2019.								

Course	e No:	Course Name:				Course Code:			
Batch	,	Programme:	Somostor:	1	т	D D D D	Crodite	Contact Hrs	
2022	•	Integrated B Sc -	Jemester.	-	•	F	creatts	ner Week	∩4
Onwai	rds	M Sc Chemistry	\sqrt{N}	3	1	0	1	Total Hrs :	60
Total	Evaluatio	n Marke: 100	v/ vi	5	⊥	0	4	Total His	00
CIE: 30 Marks		Examination Duration: 3 Hrs.							
		Pre-requisite of course : Knowledge of analytical chemistry idea of errors							
TEE: 70 Marks		and deviation, knowledge of characterization of materials.							
Course	2	Introduction of Th	eory of erro	r and treat	ment of	quantitative	e data, ac	curacy and p	recision,
Object	tives qualitative and quantitative applications, instruments and applications of theromogravimetric								
	analysis, Principles of chromatography.								
Course	e After completing this course, student is expected to learn the following:								
Outco	mes: CO1: Statistical methods in chemical analysis								
	CO2: Polarography								
	CO3: Atomic spectroscopy								
	CO4: Thermal analysis								
	CO5: Chromatography								
		CO6: Analysis of fue	el and drugs						
COURSE SYLLABUS									
NOTE:									
i) Question no. 1 is compulsory and to be set from the entire syllabus. It will have seven sub-parts and students									
need to answer any four. Each part carries three and half marks.									
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every questi	on will hav	ve three sub-p	parts and
studer	its need t	to answer any two su	ib-parts of ea	ch question.	Each part	carries sev	en marks.		Constant
Unit No	Contents						Lontact		
10.	STATISTICAL METHODS IN CHEMICAL ANALYSIS						15		
•	Theory of error and treatment of quantitative data, accuracy and precision, ways of expressing							15	
	accuracy and precision. Normal error curve and its equation. Useful statistical tests with								
	equation, test of significance, the E-test, the students t-test, the Chi-test, the correlation								
	coefficient, confidence limit of the mean, comparison of two standard values, comparison of								
	two standard values, comparison of standard deviation with average deviation, comparison								
	of mean	n with true values. r	egression an	alvsis (least	square m	ethod).	,		
II	POLAROGRAPHY AND ATOMIC SPECTROSCOPY 15								
	Current-voltage relationship, theory of polarographic waves, instrumentation, qualitative								
	and quantitative applications.								
	Atomic absorption spectroscopy, theory and application (with some examples).								
III	THERMAL ANALYSIS AND CHROMATOGRAPHY						15		
	Theory, methodology, instruments and applications of theromogravimetric analysis								
	(TGA/DTA), and differential scanning calorimetry (DSC).								
	Principles of chromatography, paper, column and thin layer chromatography, Gas-liquid								
	chromatography, HPLC.								
IV	ANALYSIS OF FUEL AND DRUGS	15							
-------	--	----------							
	Fuel analysis: Solid, liquid and gaseous fuels, ultimate and proximate analysis of solid fuel,								
	Determination of calorific value of solid, liquid and gaseous fuels, Flash point and fire point.								
	Drug analysis: Classification of drugs, Analysis of some standard drug using various								
	chromatographic techniques.								
Sugge	sted Readings:								
1.	Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.								
2.	Willard, H.H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Californ	ia, USA,							
	1988.								
3.	Christian, G.D, Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.								
4.	Harris, D.C.: Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016.								
5.	Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis								
6.	Mikes, O. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood								
7.	John Wiley 1979.								
8.	Ditts, R.V. Analytical Chemistry; Methods of separation, van Nostrand, 1974.								
9.	Khopkar, S. M., Basic Concepts of Analytical Chemistry, New Age (Second edition) 1998								

Course No:	Course Name:	w Practical			Course Code:						
Ratch:	Programme:	Somostor	•	т	363 CH 02		42 Contact Hr				
2022	Integrated B Sc -	Semester:	L	I	P	Credit		s. 04			
onwards	M Sc Chemistry	V/VI	0	0	1	2	Total Hrs ·	<u> </u>			
Total Evalua	ation Marks: 50	•/•	0	0	4	2	Total His	00			
		Examinatio	n Duration:	6 Hrs.							
CIE: 15 N	/Jarks	Pre-requisit	e of course	·Knowledg	e of analyt	ical chemis	stry idea of e	errors and			
TEE: 35 N	N arks	deviation, k	nowledge o	f character	ization of n	naterials.	stry, laca of t				
Course	Introduction of Th	eory of erro	r and treat	tment of	quantitativ	e data, ac	curacy and	precision,			
Objectives	qualitative and qu	antitative ap	plications,	instrumen	ts and app	lications c	of theromog	ravimetric			
	analysis, Principles	of chromatog	raphy.								
Course	After completing th	nis course, stu	dent is expe	ected to le	arn the follo	owing:					
Outcomes:	CO1: Statistical met	thods in chem	nical analysi	S							
	CO2: Polarography										
	CO3: Atomic spectr	oscopy									
	CO4: Thermal analy	/sis									
	CO5: Chromatogra	phy									
	CO6: Analysis of fue	el and drugs									
		-									
		(OURSE SYL	LABUS							
NOTE:											
Two questic	ons will be set, one from	each of the l	JNIT. The ca	ndidates a	re required	to attemp	ot all the que	stions.			
Unit No.			Content	ts				Contact Hrs.			
1	CHROMATOGRAPHY							30			
	1. Study the effect on	pH of addition	on of HCI/N	laOH to so	olutions of a	acetic acid	, sodium				
	acetate and their mixt	tures. Prepar	ation of bu	ffer soluti	ons of diffe	erent pH (i	. Sodium				
	acetate-acetic acid, ii.	Ammonium	chloride-an	nmonium	hydroxide						
	2. Principles involve	d in chrom	atographic	separatio	ons. Paper	chromat	ographic				
	separation of										
	i Ni (II) and Co (II)										
	I. NI (II) and CO (II)										
	11. Fe (111) driu Al (111)	paration of t	ha activa i	agradiante	of plants	flowers	nd iuicoc				
	by TIC		ine active in	Igreulents	s or plants,	nowers a	nu juices				
	by fle.										
11	CHARACTRIZATIONS							30			
	1. IR/DSC analysis of k	nown polyme	er sample (for studen	ts' demons	stration on	ly)				
	2. Determination of viscosity index, cloud point, pour point of given fuel sample.										
	3. Determination of o	. Determination of calorific value of given fuel sample/coal sample using bomb									
	calorimeter.										
		سيبية معالمه المعا									
	4. Determination of the	Determination of the iodine number of oil. Determination of the saponification number of oil.									

Suggested Readings:

- 1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.
- 2. Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi.
- 3. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009
- 4. Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Edition.

Course	e No:	Course Name:				Course Code:				
		Organic Spectrosco	ру			SBS CH 02	09 DSE 310)4		
Batch:	:	Programme:	Semester:	L	Т	Р	Credits	Contact Hrs	•	
2022		Integrated B.Sc						per Week:	04	
Onwai	rds	M.Sc. Chemistry	V/VI	3	1	0	4	Total Hrs.:	60	
Total I	Evaluatio	n Marks: 100	Examinatio	n Duration:		3 Hrs.				
CIE:	30 Mar	<s< td=""><td>Pre-requisit</td><th>e of course: l</th><td>Knowledg</td><td>e of radiatio</td><td>n and its in</td><td>teraction wit</td><td>h matter,</td></s<>	Pre-requisit	e of course: l	Knowledg	e of radiatio	n and its in	teraction wit	h matter,	
TFF:	70 Marl	(5	spectroscop			anu n	iolecules,		loleculai	
Course	, , , , , , , , , , , , , , , , , , , 	Annlication of visih	le ultraviolet	y. and infrare	d snectro	sconv in oro	ianic mole	cules Identifi	cation of	
Ohiect	tives	Functional arouns	of various classes of organic compounds Application of Chemical Shifts							
0.5,000		Application of fraar	nentation rul	e in characte	rization o	f organic co	mpounds.		ar Shijts,	
Course	2	After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:			
Outco	mes:	CO1: Basic Principle	es of UV Spect	troscopy			8.			
		CO2: Basic principle	es of IR Spec	troscopy						
		CO3: NMR (¹ H and ¹	^{L3} C NMR)							
		CO4: Basic principle	es Mass Spect	rometry						
		CO5: Use of spectro	oscopy in chai	racterizing m	olecules					
		CO6: Study of unkn	own compou	nds						
			C	OURSE SYLL	ABUS					
NOTE:										
i) Que	stion no.	1 is compulsory and	to be set fror	n the entire	syllabus. I	t will have s	even sub-p	parts and stud	lents	
need t	o answer	any four. Each part	carries three	and half mar	ks.					
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every questi	on will hav	/e three sub-j	parts and	
studer	its need t	to answer any two su	ib-parts of ea	ch question.	Each part	carries sev	en marks.		0	
Unit				Conte	nts				Contact	
INO.				,					15	
•	Annlica	tion of Woodward-	ECTROSCOPT Fiser rule in	internretati	on of Org	anic comp	ounds: An	nlication of	15	
	visihle	ultraviolet and infra	red spectros	conv in orga	nic mole	cules Flectu	omagneti	c radiation		
	electro	λ	nax & Ema	copy in orga	hore a	ixochrome	hathoch	romic and		
	hypsoch	romic shifts. App	lication of	electronic s	pectrosc	opy and V	Voodward	rules for		
	calculat	ing λ max of conjuga	ated dienes a	nd α .B – uns	saturated		s.			
	BASIC P	RINCIPLES OF IR SPE	CTROSCOPY				-		15	
	Identifi	cation of Functional	groups of va	rious classes	of organ	ic compoun	ds: Infrare	d radiation		
	and typ	es of molecular vi	brations, fur	nctional gro	up and f	ingerprint i	region. IR	spectra of		
	alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes,									
	ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching									
	absorpt	ions).								
III	NMR (¹ I	HAND ¹³ C NMR)							15	
	Applica	tion of Chemical Sh	ifts, Splitting	of signals,	Spin coup	oling and O	ver House	r effect in		
	interpre	etation of NMR spec	tra, Isotopic	exchange						
1										

IV	BASIC PRINCIPLES MASS SPECTROMETRY	15				
	Application of fragmentation rule in characterization of organic compounds. Problems on					
	structure elucidation of organic compounds based on spectral data.					
Suggested Readings:						
1.	R.M. Silverstein, G.C. Bassler & T.C. Morrill: Spectroscopic Identification of Organic Compounds, Jo	hn Wiley				
	& Sons.					

2. John R. Dyer, Applications of absorption spectroscopy of organic compounds, Prentice Hall India (2012).

Course No:	Course Name:				Course Co	de:		
	Organic Spectrosco	py Practical			SBS CH 02	10 DSE 004	42	
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact H	rs.
2022	Integrated B.Sc						per Week	04
onwards	M.Sc. Chemistry	V/VI	0	0	4	2	Total Hrs.:	60
Total Evaluation	on Marks: 50	Examinatio	n Duration:	6 Hrs.				
CIE: 15 Ma	rks	Pre-requisit matter, idea	e of cours of electror	e : Knowle nic levels in	edge of rad n atoms and	iation and I molecule	d its intera s, theory of	ction with molecular
TEE: 35 Mai	rks	spectroscop	iy.					
Course	Application of visib	le, ultraviolet	t and infrare	ed spectro	scopy in org	anic mole	cules, Identi	fication of
Objectives	Functional groups	of various	classes of (organic co	ompounds, ,	Application	n of Chemi	cal Shifts,
6	Application of fragi	nentation rul	e in charact	erization o	f organic co	mpounds.		
Course	After completing tr	iis course, stu	dent is expe	ected to le	arn the folic	wing:		
Outcomes:	CO1: Basic Principie		troscopy					
	CO3: NMR (¹ H and	¹³ C NMR)	troscopy					
	CO4: Basic principle	es Mass Spect	rometry					
CO5: Use of spectroscopy in characterizing molecules								
	CO6: Study of unkn	own compou	nds					
		<u> </u>	COURSE SYL	LABUS				
NOTE								
Two questions	will be set, one from	each of the l	JNIT. The ca	ndidates a	re required	to attemp	t all the que	estions.
Unit No.	· · · · · · · · · · · · · · · · · · ·		Content	ts	·	·	·	Contact Hrs.
I PI	JRIFICATION OF COM	IPOUNDS						30
Pi ch	urification method for for the second s	or liquid, sol	lid organic	substance	(distillatio	n, recrysta	allization,	
II CI	IARACTRIZATIONS							30
Ai St m te	Analysis of spectra of UV-Vis, FTIR, NMR and Mass of simple organic compounds. Students need to identify/analyze important peaks/functionality, determine mass of the molecules (mass-spectra). They can submit a report regarding their analysis to course teacher.							
Suggested Rea	idings:							
3. R.M.S	ilverstein, G.C. Bassle	r & T.C. Morr	ill: Spectros	copic Iden	tification of	Organic Co	ompounds, J	ohn Wiley
4. John R	s. Dyer, Applications c	fabsorption	spectroscop	y of organ	ic compoun	ds, Prentic	e Hall India	(2012).

Course	No:	Course Name:				Course Code:						
		Heterocyclic chemi	stry		1	SBS CH 02	11 DSE 310)4				
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact Hrs				
2022		Integrated B.Sc						per Week:	04			
Onward	ds	M.Sc. Chemistry	V/VI	3	1	0	4	Total Hrs.:	60			
Total E	valuatio	n Marks: 100	Examinatio	n Duration:		3 Hrs.						
CIE:	30 Mar	<s< th=""><th>Pre-requisit</th><th>e of course:</th><th>Knowled</th><th>ge of basic</th><th>organic ch</th><th>emistry, synt</th><th>hesis and</th></s<>	Pre-requisit	e of course:	Knowled	ge of basic	organic ch	emistry, synt	hesis and			
TEE:	70 Marl	<s< th=""><th>various reac</th><th>lions, knowi</th><th>eage of n</th><th>etero atoms</th><th>s in compo</th><th>unus.</th><th></th></s<>	various reac	lions, knowi	eage of n	etero atoms	s in compo	unus.				
Course	I	Synthetic approach	es and reacti	vities, natura	al product	s: synthesis	of Penicilli	n and cephal	osporine,			
Objecti	ives	general synthetic a	oproaches.									
Course	•	After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:					
Outcon	nes:	CO1: Three-membe	ered rings									
		CO2: Three-membe	ered heterocy	cles with two	o heteroa	toms						
		CO3: Four-member	ed heterocyc	les								
		CO4: Five-member	ed aromatic h	eterocycles								
		CO5: Synthesis of h	eterocycles									
	CO6: Knowledge of benzofurans and indoles											
			C	OURSE SYLL	ABUS							
NOTE:												
i) Ques	tion no.	1 is compulsory and	to be set fror	n the entire	syllabus. I	t will have s	even sub-j	parts and stud	dents			
need to	o answer	any four. Each part	carries three	and half mar	ks.							
ii) Ques	stion nos	s. 2 to 5 are to be set	from all four	units one fro	om each. Each part	Every quest	ion will hav	ve three sub-	parts and			
Linit	is need i	to answer any two st	ib-parts of ea	Conte	nts	L Carries sev	en marks.		Contact			
No.				conte	1115				Hrs.			
1	HETERC	CYCLIC CHEMISTRY							15			
	Three-m	nembered rings w	ith one he	teroatom:	Chemistr	y of oxira	nes, azir	idines and				
	episulp	hides - synthetic ap	proaches and	l reactivities								
	Three-m	nembered heterocyc	les with two	heteroatom	s: oxazira	anes, diaziri	dines and	diazirines -				
	synthet	ic approaches and r	eactivities.									
П	FOUR-N	IEMBERED HETEROO	CYCLES						15			
	oxitane	s, azatidanes and	thietanes	- synthetic	oxitanes, azatidanes and thietanes - synthetic approaches and reactivities. natural							
	products:synthesis of Peniciline and cephalosporine.											
	FIVE-MEMBERED AROMATIC HETEROCYCLES 15											
III	FIVE-MI	EMBERED AROMATI	C HETEROCYC	CLES					15			
III	FIVE-MI Applica	MBERED AROMATI tion of fragmentation	C HETEROCY(on rule in cha	CLES iracterizatio	n of orga	nic compou	nds. Prob	ems on	15			
111	FIVE-MI Applica structu	EMBERED AROMATI tion of fragmentation re elucidation of org	C HETEROCY(on rule in cha ganic compou	CLES Iracterizatio Inds based o	n of organ	nic compou al data.	nds. Prob	ems on	15			
	FIVE-MI Applica structur	EMBERED AROMATI tion of fragmentation re elucidation of org	C HETEROCYC on rule in cha ganic compou ED HETEROCY	CLES iracterizatio inds based c	n of organ	nic compou al data.	nds. Prob	ems on	15			
III IV	FIVE-MI Applica structur CONDEI Benzofu	EMBERED AROMATI tion of fragmentation re elucidation of org NSED FIVE-MEMBER uran, indoles and be	C HETEROCYC on rule in cha ganic compou ED HETEROCY nzothiazoles	CLES iracterizatio inds based c /CLES - general sy	n of organ on spectra	nic compou al data. pproaches,	nds. Prob	ems on ter	15			

Suggested Readings:

- 1. Heterocyclic Chemistry, J.A. Joule, K. Mills, Wiley, 2010.
- 2. The Essence of heterocyclic Chemistry, A. R. Parikh, H. Parikh, R. Khunt, New Age Int. Publication,
- 3. Principles of Modern Heterocyclic Chemistry, L. A. Paquette, W. A. Benjamin, New York, 1968.
- 4. Heterocyclic Chemistry, J.A. Joule and G. F. Smith, van Nostrand, London, 1978.
- 5. Comprehensive Heterocyclic Chemistry. The structure, reactions, synthesis and use of Heterocyclic compounds, (Ed. A.R. Katritzky and C. W. Rees), Vol 1-8, Pergamon Press, 1984.
- 6. Handbook of Heterocyclic Chemistry, A. R. Katritzky, Pergamon Press, 1985.
- 7. Van der plas, H. C. Ring transformations of Heterocycles, Vols 1 and 2, Academic Press, 1974.

Course No:	Course Name: Course Code:									
	Heterocyclic Chemi	stry Practical			SBS CH 02	212 DSE 00	42			
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact Hrs.			
2022	Integrated B.Sc						per Week:	04		
onwards	M.Sc. Chemistry	V/VI	0	0	4	2	Total Hrs.:	60		
Total Evaluation	on Marks: 50	Examination	n Duration:	6 Hrs.						
CIE: 15 Mar TEE: 35 Mar	ks ks	Pre-requisit various reac	e of course tions, know	: Knowled ledge of h	ge of basic etero atom	organic ch s in compo	emistry, synth ounds.	esis and		
Course Objectives	Synthetic approach general synthetic a	es and reaction proaches.	vities, natur	al product	s: synthesis	of Penicill	in and cephald	sporine,		
Course Outcomes:	After completing th	is course, stu	dent is exp	ected to le	arn the foll	owing:				
	CO2: Three-member	ared heterocy	cles with tw	n heteroa	toms					
	CO3: Four-member	ad hotoroouc								
	CO4: Five member	ed neterocyc	atorocyclos							
COE: Synthesis of heterosycles										
COS: Synthesis of hereof ware and indeled										
	COB: Knowledge of benzoturans and indoles									
		L L	OURSE SYL	LABUS						
NOTE:										
Two questions	will be set, one from	each of the L	JNIT. The ca	indidates a	are required	to attemp	ot all the quest	ions.		
Unit No.			Conten	ts			C	Contact		
								Hrs.		
	Identification of hot	oro atoms (S	N V) in gi	von organ	ic compour	ade in lab		30		
2	Identification/senar	ation of simr	, N, A) III gi Ne organic	compound	ds containi	ng hetero:	atoms			
2.	ing column chromat	organy/TLC)	in lab.	compound		ing netero				
		0.90631 . 201								
II SP		ITIFICATION /	AND PREPA	RATION				30		
1.	Spectroscopic ident	fication of si	mple organ	ic compoι	unds (spect	ra may be	provided			
to	the students and te	achers may l	nelp the stu	udents to	identify the	e compour	nds using			
sp	ectra). Melting poin	t/boiling poir	nt of the co	mpounds	may be ch	ecked for i	ts purity.			
2.	Preparation of Indi	go (using ald	lol conden	sation rea	iction of 2-	nitrobenz	aldehyde			
W	th acetone in basic of	condition).								
Suggested Ber	adinge									
1 Hetor	aunigs. Scyclic Chemistry 17		ille Milov	2010						
	cyclic Chemistry J.	A. JOULE, N. IVI	F Smith	zuiu. Van Nostr	and Londe	n 1072				
3 Comp	rehensive Heterory	lic Chemistry	The struc	ture react	tions synth	nesis and u	se of Heteroc	velie		
comp	ounds. (Ed. A.R. Katr	itzky and C. V	V. Rees). Vo	ol 1-8. Per	gamon Pre	ss. 1984.		,		
4. Handb	ook of Heterocyclic	Chemistry, A	. R. Katritzl	ky, Pergan	non Press, 2	1985.				

Course	e No:	Course Name:				Course Code:				
Databa		Organometallics an	d Bioinorgani	IC Chemistry	Ŧ	SBS CH UZ	13 DSE 310)4		
Batch:		Programme:	Semester:	L	1	Р	Credits	Contact Hrs	. 04	
2022 0pwar	rde	M Sc. Chemistry	V/VI	2	1	0	1	Total Hrs :	60	
	us Evaluatio	n Marks: 100	V/ VI	5	1	0	4	Total His.	00	
TUtari	_valuatio		Examinatio	n Duration:		3 Hrs.				
CIE:	30 Mar	ks	Pre-requisit	e of course:	Knowled	ge of metal-	carbon bo	nds and funda	amentals	
			of organom	etallic chemi	stry, idea	of metals in	n biology, I	knowledge of	proteins	
TEE:	70 Marl	<s columnation="" of="" sec<="" second="" td="" the=""><td>and enzyme</td><td>s.</td><td></td><td></td><td></td><td></td><td></td></s>	and enzyme	s.						
Course	2	Oxidation states d	isplayed by (Cr, Fe, Co, N	i and Co,	General n	nethods c	of preparation	n (direct	
Object	tives	combination, redu	ctive carbony	lation, therr	nal and p	hotochemic	cal decom	position) of m	nono and	
		binuclear carbonyl	s of 3d series	s, stabilizatio	n of prot	ein structur	es and str	uctural role (I	bones).	
Course	9	After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:			
Outco	mes:	CO1: Chemistry of 3	3d metals							
		CO2: Organometall	ic Compound	S						
		CO3: Bioinorganic o	hemistry							
		CO4: Knowledge of	various enzy	mes and prot	eins in bi	ological syst	tems			
	CO5: Ion-transport									
	CO6: Use of organometallic compounds in catalysis									
			C	OURSE SYLL	ABUS					
NOTE:										
i) Que	stion no.	1 is compulsory and	to be set fror	n the entire s	syllabus. I	t will have s	even sub-j	parts and stud	lents	
need t	o answer	any four. Each part	carries three	and half mar	ks.					
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each.	Every questi	ion will hav	ve three sub-p	parts and	
studer	nts need t	o answer any two su	ub-parts of ea	ch question.	Each part	carries sev	en marks.			
Unit				Conte	nts				Contact	
No.									Hrs.	
I	CHEMIS	TRY OF 3D METALS							15	
	Oxidati	on states displayed	by Cr, Fe, (Co, Ni and C	Co. A stu	dy of the f	ollowing	compounds		
	(includi	ng preparation and	important p	roperties); F	eroxo co	ompounds c	of Cr, K₂Cr	2O7, KMnO₄,		
	K₄[Fe(Cl	N)6], sodium nitropr	usside, [Co(N	IH₃)₀]Cl₃, Na₃[Co(NO ₂) ₆	•				
11	ORGAN	OMETALLIC COMPO	UNDS-I				6 1 1.		15	
	Definiti	on and classification	n of organom	etallic comp	ounds or	the basis c	of bond ty	pe.		
	Concep	t of hapticity of org	anic ligands.	Metal carbo	nyls: 18 e	electron rule	e, electror	n count of		
	monon	uclear, polynuclear	and substitut	ed metal ca	rbonyls o	f 3d series.	General n	nethods of		
	prepara	ition (direct combin	ation, reduct	ive carbony	ation, th	ermal and p	hotochen	nical		
	decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear									
	and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. pi-acceptor behaviour of CO (MO									
	diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back									
	ponding	· ·								
	OPCAN								10	
		colt: Proparation an	d structure	widoncos of	suporaio	offact and	comparia	n of	12	
	LEISE S	sait. Fiepaiation an c offoct with that in	a su acture, (evidences of	synergic	enect and	comparise			
	synergic effect with that in carbonyls.									

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		Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl	
		aluminium (dimer), concept of multicentre bonding in these compounds. Role of	
		triethylaluminium in polymerisation of ethene (Ziegler – Natta Catalyst). Species present in	
		ether solution of Grignard reagent and their structures, Schlenk equilibrium.	
		Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich	
		Condensation). Structure and aromaticity. Comparison of aromaticity and reactivity with that	
		of benzene.	
		Definition and Classification with appropriate examples based on nature of metal-carbon	
		bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and	
		ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties	
		of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon	
		monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic	
		effect to IR frequencies). Organometallic compounds of Mg and Li – Use in synthesis of	
		organic compounds.	
	IV	BIOINORGANIC CHEMISTRY	15
		A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological	
		systems with special reference to Na+, K+ and Mg2+ ions: Na/K pump; Role of Mg2+ ions in	
		energy production and chlorophyll. Role of Ca2+ in blood clotting, stabilization of protein	
		structures and structural role (bones).	
:	Sugge	sted Readings:	
.	1.Lipp	ard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.	
	2. Cot	ton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry Wiley-VCH, 1999	
	3. Bas	olo, F, and Pearson, R.C. Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.	
4	4.Gree	enwood, N.N. & Earnshaw A. Chemistry of the Elements, Butterworth-Heinemann, 1997.	

Course No:	Course Name:				Course Code:				
	Organometallics an	d Bioinorgani	c chemistry	Practical	SBS CH 02	14 DSE 004	42		
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact Hrs.		
2022	Integrated B.Sc						per Week:	04	
onwards	M.Sc. Chemistry	V/VI	0	0	4	2	Total Hrs.:	60	
lotal Evalua	cion Marks: 50	Examinatio	n Duration:	6 Hrs.					
CIE: 15 M	arks	Pre-requisit	e of course	: Knowledg	ge of metal-	carbon bo	nds and funda	mentals	
		of organom	etallic chem	istry, idea	of metals in	n biology, I	knowledge of	proteins	
TEE: 35 M	arks	and enzyme	s.						
Course	Oxidation states d	isplayed by C	Cr, Fe, Co, I	Ni and Co,	General r	nethods c	of preparation	n (direct	
Objectives	combination, redu	ctive carbony	lation, ther	mal and p	hotochemi	cal decom	position) of m	ono and	
	binuclear carbonyl	s of 3d series	s, stabilizati	on of prot	ein structur	res and str	uctural role (l	bones).	
Course	After completing th	is course, stu	dent is expe	ected to lea	arn the follo	wing:			
Outcomes:	CO1: Chemistry of S	3d metals							
	CO2: Organometall	ic Compound	S						
	CO3: Bioinorganic o	hemistry							
	CO4: Knowledge of	various enzy	mes and pro	oteins in bi	ological syst	tems			
	CO5: Ion-transport								
	CO6: Use of organo	metallic com	pounds in ca	atalysis					
	COURSE SYLLABUS								
NOTE:									
Two question	ns will be set, one from	each of the L	JNIT. The ca	ndidates a	re required	to attemp	t all the quest	ions.	
Unit No.			Content	s				Contact	
								Hrs.	
	GRIGNARD REAGENT							30	
	L.Rection of metal wit	h halide – pro	eparation o	f Grignard	l reagent. (d	only			
	demonstration purpos	e) n of due (mo	lachita ara	n lucing m	a a thuile a n a	ata) /am/at			
	2. Grignard preparatio	n of uye (ma	natorial ac	en (using r	netnyibeno	ale)/cryst			
	demonstration nurnes				, n-aimetri	iyi aniine)	(Only		
II	PREPARATION OF CON	APLEXES						30	
	L. Preparation of vari	ous Schiff ba	se-metal c	omplexes	and their i	dentificati	on using		
	spectroscopy.						Ū.		
	2. Preparation of any t	wo of the fo	llowing com	nplexes an	d measure	ment of th	neir		
	conductivity measurer	nent:							
	a. tetraamminecarbon	atocobalt (III	l) nitrate						
b. tetraamminecopper (II) sulphate									
	c. potassium trioxalato	oferrate (III) t	rihydrate						
Suggested R	eadings:								
1. Synt	hesis of organometalli	c compound	s: A practic	al guide, S	. Komiya, V	Viley.			
2. A.I. \	/ogel: Qualitative Inor	ganic Analysi	is, Prentice	Hall, 7th E	dn.		6 - - - - -		
3. Voge	el, A.I., Tatchell, A.R., F	urnis, B.S., H	lannaford, A	A.J. & Smit	:h, P.W.G.,	I extbook	of Practical O	rganic	
Cher	nistry, Prentice-Hall.								

120 | P a g e

Course	e No:	Course Name:			_	Course Code:				
		Introduction to Nar	ocnemistry &	Application	s	SBS CH 02	15 DSE 310)4		
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact Hrs		
2022	e al a	Integrated B.Sc	<u>, , , , , , , , , , , , , , , , , , , </u>	2	1	0		per week:	04	
Unwar		IVI.SC. Chemistry	V/VI	3	1	0	4	Total Hrs.:	60	
Iotal	valuatio	n Marks: 100	Examination	n Duration:		3 Hrs.				
CIE:	30 Mar	ks	Pre-requisit	e of course	e: Knowle	edge of na	nomateria	als, its synth	esis and	
			characteriza	tions, idea o	f carbon r	nanotubes, f	ullerene, g	graphene etc.		
TEE:	70 Marl	<s< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th></s<>								
Course	2	Introduction to nai	noscience, Ele	ectrical, Opti	cal (Surfa	ice Plasmor	resonanc	e), variation	in colors	
Object	tives	(Blue shift & Red sl	nift), Magneti	c, thermal a	nd cataly	tic propertie	es, Brief in	troduction ab	out Top-	
_		down and Bottom-	up approache	s, Electron m	nicroscopi	<u>c technique</u>	•			
Course	9	After completing th	is course, stu	dent is expe	cted to lea	arn the follo	wing:			
Outco	mes:	CO1: Introduction t	o nanoscienc	е						
		CO2: Calculation of	percentage c	of surface ato	om and su	rface to volu	ume ratio	of spherical, v	vire, rod,	
	and disc shapes nanoparticles.									
		CO3: Examples of p	reparation of	gold and silv	er metall	ic nanoparti	icles,			
	CO4: Material characterization techniques									
	CO5: Advanced application of nanomaterials									
	CO6: Knowledge of quantum dots									
			C	OURSE SYLL	ABUS					
NOTE:										
i) Que	stion no.	1 is compulsory and	to be set fron	n the entire s	syllabus. I	t will have s	even sub-j	parts and stud	lents	
need t	o answer	any four. Each part	carries three	and half mar	ks.					
ii) Que	estion nos	s. 2 to 5 are to be set	from all four	units one fro	om each. I	Every questi	ion will hav	ve three sub-p	parts and	
studer	nts need t	o answer any two su	b-parts of ea	ch question.	Each part	carries sev	en marks.			
Unit				Conte	nts				Contact	
No.									Hrs.	
I	INTROD	UCTION							25	
	Introdu	ction to nanoscience	ce, nanostru	cture and n	anotechn	ology (basi	ic idea), C	Overview of		
	nanostr	uctures and nand	-materials,	classification	n, (cluste	er, colloid,	nanopar	ticles, and		
	nanostr	uctures -Spheroid,	Wire, Rod, I	ube, and Qu	antum D	ot); Calcula	tion of pe	rcentage of		
	surface	atom and surfac	e to volum	e ratio of	spherica	l, wire, ro	d, and c	lisc shapes		
	nanopa	rticles.								
11	PROPER		RIALS	· · // ·		c		.	20	
	Size de	bendent properties	of nanomate	erials (basic	idea with	few exam	oles only):	Quantum		
	confine	ment, Electrical, Op	tical (Surface	Plasmon re	sonance)	, variation i	n colors (E	slue shift &		
	Red shi	rt), Magnetic, therm	al and cataly	rtic propertie	es.					
111	SYNIHE		(IALS	unting share	+ Tara di-		+	www.aabaa		
	Synthes	as or inanomaterials	. Brief Introd	iclos suste		wn and Bot	tom-up ap	pproaches		
	a self-a	ssembly techniques	or motallic a	anonarticles	sis, SUIVO	ombled per	ness, Exal			
	prepara	nion of gold and Silv		ional contra	, sell-dss		and incre	es-		
	control	or nanoarchitecture	-one unnens	ional contro	i. Carbon	nanotupes	anu morg	anne		
	nanowi	165.								

IV CHARACTERIZATION OF NANOMATERIALS						
Material characterization techniques (basic idea of use of following instruments i	1					
nanomaterial characterization need to be emphasized): Electron microscopic technique	,					
diffraction technique, photoelectron spectroscopy, zeta-potential measurement; Examples of	f					
use of nanomaterials in environmental remediation and biology (few practical examples of	f					
use of materials can be discussed).						
Suggested Readings:	·					
1.C. N. R. Rao, A. Muller, A. K. Cheetam, The Chemistry of Nanomaterials: Synthesis, Properties and						
Applications, Willey-VCH Verlag, Germany, 2005.						
2.G. Cao, Nanostructures and Nanomaterials: Synthesis, Properties and Appications, Imperial Colleg	e Press,					
London, 2004						
3.R. W. Kelsall, I. W. Hameley, M. Geoghegan, Nanoscale Science and Technology, John Wiley & Sor	s,					
England, 2005						
4.Charles P. Poole and Frank J Owens, <i>Introduction to nano technology</i> , Wiley Interscience, 2003.						
5. Pradeep, T., A text of book of nanoscience and nanotechnology, Tata McGraw Hill Education Pvt.	Ltd., New					
Delhi, 2012.						

Course No:	Course Name:	Course Name: Course Code:							
	Nanochemistry Pra	ctical			SBS CH 02	16 DSE 00	42		
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact H	lrs.	
2022	Integrated B.Sc						per Weel	c: 04	
onwards	M.Sc. Chemistry	V/VI	0	0	4	2	Total Hrs	.: 60	
Total Evalu	ation Marks: 50	Examinatio	n Duration:	6 Hrs.					
CIE: 15 M	Marks	Pre-requisit	e of course	: Knowle	edge of na	nomateria	als, its syn	thesis and	
TEE: 35 M	Marks	characteriz	ations, idea	of carbo	n nanotube	es, fullerei	ne, grapher	ne etc.	
Course	Introduction to na	noscience, El	ectrical, Opt	tical (Surfa	ice Plasmoi	n resonan	ce), variatic	on in colors	
Objectives	(Blue shift & Red s	hift), Magnet	ic, thermal a	and cataly	tic properti	es, Brief in	troduction	about Top-	
	down and Bottom-up approaches, Electron microscopic technique.								
Course	After completing th	is course, stu	dent is expe	ected to lea	arn the follo	owing:			
Outcomes:	CO1: Introduction t	o nanoscienc	e						
	CO2: Calculation of	percentage of	of surface at	om and su	rface to vol	ume ratio	of spherica	l, wire, rod,	
	and disc shapes nar	and disc shapes nanoparticles.							
	CO3: Examples of p	CO3: Examples of preparation of gold and silver metallic nanoparticles,							
	CO4: Material char	CO4: Material characterization techniques							
	CO5: Advanced app	lication of na	nomaterials	5					
	CO6: Knowledge of	quantum do	ts						
	I	(COURSE SYL	LABUS					
NOTE:									
Two question	ons will be set, one from	each of the l	JNIT. The ca	ndidates a	re required	l to attemp	ot all the qu	estions.	
Unit No.			Content	S				Contact Hrs.	
1	SYNTHESIS OF NANOP	ARTICLES						30	
	1.Synthesis of ZnO nar	noparticles.							
	2. Preparation of Silve	r nanoparticl	es.						
	(diverse nanoparticles	can be prep	ared by var	ious route	s)				
11	BEER-LAMBERT LAW							30	
	Verfification of Beer-L	ambert law u	sing nano-p	oarticles (a	bove prepa	ared nano	-particles		
	may be used for the st	udy).							
Suggested	Readings:								
1. Pra	deep T., A text book of	nanoscience	and nanot	echnology	. Tata McG	raw Hill F	ducation P	/t. Ltd.	
Nev	New Delhi, 2012 edition								

Sr. No.	Name of the course	Course Code	L	Т	Р	Credits
1	GE: Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	SBS CH 020101 GE 4004	4	0	0	4
2	GE-Lab: Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	SBS CH 020102 GE 0042	0	0	4	2
3	GE: Chemical Energetics, Equilibria & Functional Organic Chemistry-I	SBS CH 020103 GE 4004	4	0	0	4
4	GE Lab: Chemical Energetics, Equilibria & Functional Organic Chemistry-I	SBS CH 020104 GE 0042	0	0	4	2
5	Solutions, Phase Equilibria, Conductance, Electrochemistry, & Functional Group Organic Chemistry	SBS CH 020201 GE 4004	4	0	0	4
6	GE Lab: Solutions, Phase Equilibria, Conductance, Electrochemistry, & Functional Group Organic Chemistry	SBS CH 020202 GE 0042	0	0	4	2
7	GE: Transition Metal & Coordination Chemistry, States of Matter & Chemical Kinetics	SBS CH 020203 GE 4004	4	0	0	4
8	GE Lab: Transition Metal & Coordination Chemistry, States of Matter & Chemical Kinetics	SBS CH 020204 GE 0042	0	0	4	2
9	Organometallics, Bio-inorganic Chemistry, Polynuclear Hydrocarbons & UV, IR Spectra	SBS CH 020301 GE 4004	4	0	0	4
10	GE Lab: Organometallics, Bio- inorganic Chemistry, Polynuclear Hydrocarbons & UV, IR Spectra	SBS CH 020302 GE 0042	0	0	4	2
11	GE: Quantum Chemistry, Spectroscopy & Photochemistry	SBS CH 020303 GE 4004	4	0	0	4
12	GE Lab: Quantum Chemistry, Spectroscopy & Photochemistry	SBS CH 020304 GE 0042	0	0	4	2
13	Molecules of Life	SBS CH 020401 GE 4004	4	0	0	4

List of GE Courses To Be Offered To The Other Departments

14	GE Lab: Molecules of Life	SBS CH 020402 GE 0042	0	0	4	2
15	Chemistry of Main Group Elements, Theories of Acids & Bases	SBS CH 020403 GE 4004	4	0	0	4
16	GE Lab: Chemistry of Main Group Elements, Theories of Acids & Bases	SBS CH 020404 GE 0042	0	0	4	2

Note:

- 1. University/Department may include more options or delete some from this list.
- 2. The courses will be offered according to faculty strength and as per availability of faculty members.

Course No:	Course Name:	Course Name: Course Code:								
	GE: Atomic Structu	re, Bonding, (General Orga	nic	SBS CH 02	0101 GE 40	004			
Batch	Programme:	Semester		т	D	Credits	Contact	Hrc		
2022	Integrated B.Sc	Semester.	L .	•	F	creats	per Wee	his. k:	04	
Onwards	M.Sc.	I	4	0	0	4	Total Hrs	5.:	60	
Total Evalua	tion Marks: 100	Examination	Examination Duration: 3 Hrs.							
CIE: 30 N	arks	Pre-requisite of course: None								
TEE: 70 N	arks									
Course Objective	urseTo provide basic knowledge of fundamentals of inorganic chemistry and organic chemistry to thejectivestudents.									
Course	After completing th	is course, stu	dent is expe	cted to le	arn the follo	owing:				
Outcomes:	CO1 : The wave fun	ction								
	diagrams	id geometries	s of molecu	les using	Radius Rat	io Rules, v	SEPR theo	ory an	a MO	
	CO3: Importance a	and applicatio	on of chemi	cal bonds	. inter-mol	ecular and	l intramol	ecular	weak	
	chemical forces and	their effect			,					
	CO4: The nature an	d behavior of	organic com	npounds						
	CO5:Mechanisms	of severa	l organic	reactio	ns includi	ng free	radical/	electro	ophilic	
	substitution/additio	on Stal son sonta	of otorio o ob o							
				LADUS						
NOIE:	o 1 is compulsory and	to be set from	n tha antira	syllabur, I	t will have a		parts and s	tudon	tc	
need to answ	ver any four. Fach part	carries three	and half mar	synabus. i .ks.	t will have s	seven sub-	Jai ts anu s	luuen	15	
ii) Question	nos. 2 to 5 are to be set	from all four	units one fro	om each.	Every quest	ion will hav	ve three su	ıb-par	ts and	
students nee	ed to answer any two su	ub-parts of ea	ch question.	Each par	t carries sev	ven marks.		•		
Unit			Contents					Cor	ntact	
No.								Н	rs.	
INO	RGANIC CHEMISTRY-1									
								1	14	
Revi	ew of Bohr's theory a	and its limita	tions, dual	behaviou	r of matte	r and radia	tion de			
Brog	lie's relation, Heisenbe	rg Uncertaint	y principle. I	lydrogen	atom spect	ra. Need o	f a new			
app	oach to Atomic structu	ure.	, , , ,	, 0	·					
Wha	t is Quantum mechar	nics? Time in	dependent (Schroding	er equation	n and mea	ning of			
Varia	us terms in it Signifi	cance of ili a	nd ull ² Schr	ödingor	austion fo		n atom			
Radi	al and angular narts	of the hydro	nu φ , schi genic wave	functions	atomic c	rhitals) ar	nd their			
varia	ations for 1s, 2s, 2p, 3s	, 3p and 3d c	orbitals (Only	/ graphica	al represent	tation). Ra	dial and			
angi	lar nodes and their si	gnificance. Ra	adial distribu	ution fund	tions and t	the concep	t of the			
mos	t probable distance wi	th special refe	erence to 1s	and 2s at	tomic orbita	als. Signific	ance of			
qua	ntum numbers, orbital	angular mon	nentum and	quantum	numbers <i>i</i>	m/ and <i>ms</i> .	Shapes			

	of <i>s</i> , <i>p</i> and <i>d</i> atomic orbitals, nodal planes. Discovery of spin, spin quantum number(<i>s</i>) and magnetic spin quantum number (m_s).	
	Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.	
	, G	
11	 CHEMICAL BONDING AND MOLECULAR STRUCTURE Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character. Covalent Bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic and organic compounds. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for <i>s-s, s-p</i> and <i>p-p</i> combinations of atomic orbitals, nonbonding combination of orbitals MO treatment of bomonuclear diatomic molecules of 1st and 	16
	2nd periods (including idea of <i>s</i> - <i>p</i> mixing) and heteronuclear diatomic molecules of 1st and such as CO, NO and NO ^{$+$} . Comparison of VB and MO approaches.	
	ORGANIC CHEMISTRY-1	
ш	FUNDAMENTALS OF ORGANIC CHEMISTRY	16
	 Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule. Stereochemistry: Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; <i>cis-trans</i> nomenclature; CIP Rules: R/S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems). 	
IV	ALIPHATIC HYDROCARBONS Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Alkanes: (Upto 5 Carbons) Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.	14

hydrogenation) and trans alkenes (Birch reduction). Reactions: cis addition (alk. KMnO₄) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation. **Alkynes**: (Upto 5 Carbons) Preparation: Acetylene from CaC₂ and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: Formation of metal acetylides, addition of bromine and alkaline KMnO₄, ozonolysis and oxidation with hot alk. KMnO₄

Suggested Readings:

- 1. J. Singh, L.D.S. Yadav, Organic Chemistry (Volume I), 14th Edition, Pragati Prakashan, 2019.
- 2. T.W. Graham Solomon, C.B. Fryhle, & S.A. Dnyder, Organic Chemistry, John Wiley & Sons, 2014.
- 3. J.E. McMurry, Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning Edition, 2013.
- 4. S. M. Mukerji, S. P. Singh, K.P.Kapoor and R. Das, Organic Chemistry (Volume I), 2nd Edition, New Age International Publishers, 2010.
- 5. R.T. Morrison & R.N. Boyd, Organic Chemistry, Pearson, 2010.
- 6. A. Bahl, & B.S. Bahl, S. Chand, Advanced Organic Chemistry, 2010.
- 7. J.E. Huheey, E.A. Keiter, R.L. Keiter, & O.K. Medhi, Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
- 8. E.L. Eliel, Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000.
- 9. F.A. Cotton, G. Wilkinson, & P.L. Gaus, Basic Inorganic Chemistry, 3rd Edition, Wiley, 1995.
- 10. J.D. Lee, Concise Inorganic Chemistry ELBS, 1991.
- 11. P. Sykes, A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi 1988.
- 12. Cotton, F.A., Wilkinson, G. & Gaus, P.L., Basic Inorganic Chemistry, 3rd Edition, Wiley, 1995.
- 13. Finar, I.L. Organic Chemistry (Volume I & II), E.L.B.S., 1988.

Course No:	Course Name:	Course C	Course Code:						
	GE-Lab: Atomic Str	ucture, Bond Itic Hydrocar	ing, Genera bons	I Organic	SBS CH 02	20102 GE 0	042		
Batch: 2022	Programme: Integrated B.Sc	Semester:	L	Т	Р	Credit	Contact H per Week	rs.	04
Onwards	M.Sc.	I	0	0	4	2	Total Hou	rs:	60
Total Evaluat	ion Marks: 50	Examinatio	n Duration:	6 Hrs.					
CIE: 15 Ma	arks	Pre-requisite of course: None							
TEE: 35 Ma	arks								
CourseTo inculcate the common skills required for performing simple inorganic and organic chObjectivepracticals.							chen	nistry	
Course Outcomes:	CourseAfter completing this course, student is expected to learn the following:Outcomes:CO1: The estimation techniques by volumetric analysisCO2: The handling skills of simple chemicals, glassware and small equipment.CO3: The qualitative analysis of simple organic compounds								
		CO	URSE SY	LLABUS					
NOTE:									
Two questions	will be set, one from eac	ch of the UNIT.	The candida	tes are requ	ired to atter	npt all the c	questions.	Con	tact
Office No.			content	.5				H	rs.
I INORGANIC CHEMISTRY VOLUMETRIC ANALYSIS i. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture. ii. Estimation of oxalic acid by titrating it with KMnO ₄ . iii. Estimation of water of crystallization in Mohr's salt by titrating with KMnO ₄ . iv. Estimation of Fe (II) ions by titrating it with K2Cr2O7 using internal indicator. v. Estimation of Cu (II) ions iodometrically using Na2S2O3.							3	0	
	DRGANIC CHEMISTRY QUAILITATIVE ANALYS i. Detection of extra erew two extra elements). ii. Separation of mix combination of two co a) Identify and separ glycine, aspartic acid chromatography.	IS OF ORGAN elements (N, atures by Chi pompounds to rate the com , glutamic ad	IIC COMPO S, Cl, Br, I) romatograp be given) nponents of cid, tyrosing	UNDS in organic hy: Measu a given n e or any	compound ire the Rf mixture of other amir	s (containi value in e two amir no acid) b	ng upto each case no acids y paper	3	0

	(b) Identify and separate the sugars present in the given mixture by paper chromatography.							
Suggested	Readings:							
1. 0	1. G. Svehla, Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.							
2. J.	Mendham, Vogel's Quantitative Chemical Analysis, Pearson, 2009.							
3. A	.I. Vogel, Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic							
Chemistry	, Prentice-Hall, 5 th Edition, 1996.							
4. F	.G. Mann, & B.C. Saunders, Practical Organic Chemistry Orient-Longman, 1960.							

Course	No:	Course Name:				Course Code:				
		GE: Chemical Ene	rgetics, Equ	ilibria & Fu	inctional	SBS CH 0	20103 GE	4004		
		Organic Chemistr	y-l		1		1	T		
Batch:		Programme:	Semester:	L	Т	Р	Credits	Contact I	Hrs.	
2022 Onward	de	Integrated B.Sc		1	0	0	1	per wee	<u>k: 04</u> · 60	
	u	N		4	0	0	4	Total IIIs	00	
l otal E	valuatio	n Marks: 100	Examination	n Duration:		3 Hrs.				
CIE:	30 Mar	ks								
			Pre-requisit	e of course:	None					
TEE:	70 Mar	KS								
Course	ivo	To provide basic kni	owledge of cl Logrhopyl co	nemistry of a mnounds	iromatic h o provida	ydrocarboi basis undo	ns, alky and rstanding (l aryl halid of chomica	es, alcohols, Lonorantics	
Objecti	ve	chemical equilibriur	n and ionic ed	nipounas. n auilibria.) provide		istuniuniy t	<i>J</i> chemical	energencs,	
Course		After completing th	is course, stu	dent is expe	cted to lea	arn the foll	owing:			
Outcon	nes:	CO1: Basics of chem	nical energeti	cs.						
		CO2: Basics of chem	nical equilibri	um and ioni	c equilibria	Э.				
		CO3 : Chemistry of a	iromatic hydr	ocarbons, al	lky and ary	/I halides.	unds			
						inyi compo				
			CO	URSE SYL	LABUS					
NOTE:		4 ······								
I) Ques	tion no.	1 is compulsory and	to be set fron	n the entire and half mai	syllabus. I rks	t will have	seven sub-	parts and s	tudents	
ii) Ques	stion nos	s. 2 to 5 are to be set	from all four	units one fr	om each. I	Every quest	tion will ha	ve three su	b-parts and	
student	ts need t	to answer any two su	b-parts of ea	ch question.	. Each part	carries sev	ven marks.		•	
Unit				Contents					Contact	
No.									Hrs.	
	PHYSIC	CAL CHEMISTRY-1							1 Г	
1	CHEIVII	CAL ENERGETICS							15	
	Review	of thermodynamics	and the Law	s of Thermo	dynamics					
	Import	ant principles and d	efinitions o	f thermoch	nemistry.	Concept	of standar	dstate		
	and st	andard enthalpies of	formations,	integral and	different	ial enthalp	ies of solut	tion and		
	thermo	n. Calculation of bon ochemical data Vari	a energy, boi ation of enth	nd dissociation	action wi	th temper:	ature – Kir	chhoff's		
	equation	on.		alpy of a re		th temper				
	Statem	ent of Third Law	of thermod	ynamics ar	nd calcula	ition of a	bsolute e	ntropies		
	of subs	stances.								
11	CHFMI								15	
	Chemio	cal Equilibrium: Fre	e energy cl	hange in a	chemica	l reaction	. Thermo	dynamic	1.5	
	derivat	ion of the law of cl	nemical equil	ibrium. Di	stinction	between Z	AG and L	∆G [°] , Le		
	Chateli	er's principle. Re	lationships b	etween <i>K_p,</i>	K_c and K_x	for reaction	ons involvi	ng ideal		
	gases.									

	Ionic Equilibrium: Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle	
	ORGANIC CHEMISTRY-2	
111	 AROMATIC HYDROCARBONS Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene). ALKYL AND ARYL HALIDES Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions. Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution. Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH2/NH3 (or NaNH2/NH3). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides 	15
IV	ALCOHOLS, PHENOLS AND ETHERS (UPTO 5 CARBONS)	15
	 Alcohols: <i>Preparation:</i> Preparation of 1⁰, 2⁰ and 3⁰ alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. <i>Reactions:</i> With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO4, acidic dichromate, conc. HNO3). Oppeneauer oxidation <i>Diols:</i> (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement. Phenols: (Phenol case) <i>Preparation:</i> Cumene hydroperoxide method, from diazonium salts. <i>Reactions:</i> Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction. Ethers (aliphatic and aromatic): Cleavage of ethers with HI. Aldehydes and ketones (aliphatic and aromatic): (Formaldehye, acetaldehyde, acetone and benzaldehyde) <i>Preparation:</i> from acid chlorides and from nitriles. <i>Reactions –</i> Reaction with HCN, ROH, NaHSO₃, NH₂-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. 	

Suggested Readings:

1. S. M. Mukherji and S. P. Singh, Reaction Mechanism in Organic Chemistry, Revised Edition. (Revised by S. P. Singh and Om Prakash). TRINITY Press, An Imprint of Laxmi Publications Pvt. Ltd., 2015.

2. T.W. Graham Solomon, C.B. Fryhle, & S.A. Dnyder, Organic Chemistry, John Wiley & Sons, 2014.

3. J.E. McMurry, Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

4. S. M. Mukerji, S. P. Singh, K.P.Kapoor and R. Das, Organic Chemistry (Volume II), 2nd Edition, New Age International Publishers, 2010.

5. S. M. Mukerji, S. P. Singh, K.P.Kapoor and R. Das, Organic Chemistry (Volume I), 2nd Edition, New Age International Publishers, 2010.

- 6. I.L. Finar, Organic Chemistry (Volume I & II), E.L.B.S.
- 7. R.T. Morrison, & R.N. Boyd, Organic Chemistry, Pearson, 2010.
- 8. A. Bahl, & B.S Bahl, S. Chand, Advanced Organic Chemistry, 2010.

9. J.C. Kotz, P. M. Treichel, & J. R. Townsend, General Chemistry Cengage Learning India Pvt. Ltd., New Delhi, 2009.

- 10. G.M. Barrow, Physical Chemistry, Tata McGraw-Hill, 2007.
- 11. G.W. Castellan, Physical Chemistry, 4th Edition, Narosa, 2004.
- 12. P. Sykes, A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi, 1988.
- 13. B.H Mahan, University Chemistry, 3rd Edition, Narosa, 1998.
- 14. R.H. Petrucci, General Chemistry, 5th Edition, Macmillan Publishing Co.: New York, 1985.

Course No:	Course Name: GE Lab: Chemical Functional Organ	Course Name:Course Code:GE Lab: Chemical Energetics, Equilibria &SBS CH 020104 GE 0042Functional Organic Chemistry-ISBS CH 020104 GE 0042						
Batch: 2022	Programme: Integrated B.Sc	Semester:	L	Т	Р	Credit	Contact Hi per Week:	rs. 04
Onwards	M.Sc.	I	0	0	4	2	Total Hrs:	60
Total Evaluation	on Marks: 50	Examinatio	n Duration:	6 Hrs.				
CIE: 15 Mar	rks	Pre-requisite of course: None						
TEE: 35 Mar	KS	lls for handli	na roaction	c to propo	ara cimpla	organic co	manunda	To provida
Objective	knowledge about the purification techniques for organic compounds and their m.pt determination to the students. To explain the importance and applications of thermochemistry and to calculate the pH of the different solutions.							
Course	After completing this course, student is expected to learn the following:							
Outcomes:	CO1: Thermochemistry and its applications in chemistry							
	CO2 : For the equilibria and measurement of pH of different solutions.							
	CO4: Single-step organic preparations and purification of the obtained product							
	I	CC	URSE SYI	LABUS				
NOTE:								
Two questions v	vill be set, one from eac	ch of the UNIT.	The candidat	tes are requ	ired to atter	npt all the c	uestions.	Contract
	Contents							Hrs.
I PI	HYSICAL CHEMISTRY							30
In	ermochemistry 1 Determination	of heat can	acity of calo	rimeter fo	r different :	volumes		
	2. Determination	of enthalpy	of neutraliz	ation of hy	/drochloric	acid with		
	3. Determination	n of enthalov	of ionizatio	n of acetic	acid			
	4. Determination	n of integral e	enthalpy of	solution of	f salts (KNO	3, NH4Cl).		
	5. Determination 6. Study of the s	n of enthalpy olubility of b	of hydratio	n of coppe in water a	er sulphate. Ind determine	nation of A	NH.	
10	nic equilibria							
pi M ar gl	pH measurements Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter. a) Preparation of buffer solutions: (i) Sodium acetate-acetic acid (ii)Ammonium chloride-ammonium hydroxide							
th	eoretical values.	אווומ וס חק	solutions	anu con	iparison of	ule valu	es with	
II O	RGANIC CHEMISTRY 1. Purification of alcohol) and c 2. Criteria of Pur	 CANIC CHEMISTRY 1. Purification of organic compounds by crystallization (from water and alcohol) and distillation. 2. Criteria of Purity: Determination of melting and boiling points. 						30

3.	Preparations: Mechanism of various reactions involved to be discussed.
	Recrystallisation, determination of melting point and calculation of
	quantitative yields to be done.
(a)	Bromination of Phenol/Aniline
(b)	Benzoylation of amines/phenols
(c)	Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone
Suggested Readings	
1 B D Khosla	· V. C. Gara & A. Gulati Sonior Practical Physical Chamistry, P. Chand & Co. Naw
I. D.D. MIOSIA	, V.C. Oaig & A. Oulau Sellioi Flactical Fliysical Chemistry, R. Chand & Co., New
Delhi (2011).	
2. A.L. Vogel,	A.R. Tatchell, B.S. Furnis, A.J. Hannaford & P.W.G. Smith Textbook of Practical
Organic Chemistry, P	rentice-Hall, 5th edition, 1996.
3 F.G. Mann &	z B.C. Saunders Practical Organic Chemistry Orient-Longman, 1960.
L	

Course No:	Course Name:		Course Co	Course Code:				
	GE: Solutions, Pha	ase Equilibi	ria, Cond	uctance,	SBS CH 0	20201 GE	4004	
	Electrochemistry	& Function	nal Group	Organic				
	Chemistry-li		-	•		-		
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact Hrs	
2022	Integrated B.Sc						per Week:	04
Onwards	M.Sc. Chemistry	I	4	0	0	4	Total Hours	60
Total Evalu	ation Marks: 100	Examinatio	n Duration:	3 Hrs.				
CIE: 30 M	Marks	Pre-requisit	e of course	e: Basic ur	nderstandin	g of solut	ions, phase e	guilibria.
TEE: 70 M	Marks	basic organi	ic reactions.			5 01 00100		quinoria)
Course	To provide student	s with basic	concept of	different t	types of bir	nary soluti	ons, phase eq	uilibria ,
Objective	conductance, orgar	nic reactions.						
Courses	After completing th		dont in		are the fall			
Course	After completing th	ils course, stu	ident is expe	ected to lea	arn the folio	owing:	partially mice	tible and
Outcomes:	immiscible along w	ith their annl	ications		ry solution:	s-misciple,	partially mist	
	CO2 : Explain the th	ermodynami	c aspects of	equilibria ł	petween ph	ases and d	lraw phase dia	grams of
	simple one compor	ent and two	component	systems	,			8
	CO3: Explain the fa	ctors that aff	ect conducta	, ance, migr	ation of ion	s and appl	ication of cond	ductance
	measurement			-				
	CO4: Understand c	lifferent type	es of galvani	ic cells, the	eir Nernst e	equations,	measurement	t of emf,
	calculations of ther	modynamic p	properties a	nd other p	arameters f	rom the ei	mf measurem	ents
	CO5: Understand a	nd demonstr	ate how the	e structure	of biomole	ecules dete	ermines their	chemical
	properties, reactivi	ty and biolog	ical uses			I.		
	CO6: Design newer	synthetic rol	ates for varie	ous organie	c compound	as		
				LADUS				
NOTE:								
i) Question	no. 1 is compulsory and	to be set from	m the entire	syllabus. I	t will have s	seven sub-	parts and stud	ents
need to ans	wer any four. Each part	from all four	and half ma	irks.		المربية المراجع	vo throp cub	orto
and studen	ts need to answer any ty	non an ioni vo sub-parts	of each que	om each.	nart carrie	ION WIII Nd	ve three sub-p arks	Jarts
Unit No.	to need to answer any th	o 300-parts (Content			5 56 7 611 1110	((Contact
			content					Hrs.
1	SOLUTIONS AND PHAS	E EQUILIBRIA	•					15
	Solutions							
	Thermodynamics of id	eal solutions	: Ideal solut	tions and	Raoult's lav	v, deviatio	ons from	
	Raoult's law – non-ide	eal solutions	s. Vapour p	pressure-co	omposition	and temp	erature-	
	composition curves of	ideal and nor	n-ideal solut	ions. Distil	lation of so	lutions. Le	ver rule.	
	Azeotropes.							
	Partial miscibility of liq	uids: Critical	solution ter	mperature	; effect of i	mpurity or	n partial	
	miscibility of liquids. Ir	nmiscibility o	of liquids- P	rinciple o	f steam d	istillation.	Nernst	
	distribution law and its	applications,	solvent ext	raction.				
	Phase Equilibria							

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Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, FeCl ₃ -H ₂ O and Na-K only).IIIICONDUCTANCE AND ELECTROCHEMISTRY15Conductance Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements:
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boundary methods. Ionic mobility. Applications of conductance measurements:
boundary methods. Joine mobility. Applications of conductance measurements.
determination of degree of ionization of weak electrolyte solubility and solubility
products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt.
Conductometric titrations (only acid- base).
Electrochemistry
Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell.
Nernst equation and its importance. Types of electrodes. Standard electrode potential.
Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic
properties: ΔG , ΔH and ΔS from EMF data.
Calculation of equilibrium constant from EMF data. Concentration cells with transference
and without transference. Equid junction potential and sait bridge.
Potentiometric titrations -gualitative treatment (acid-base and oxidation-reduction only).
III CARBOXYLIC ACIDS AND THEIR DERIVATIVES, AMINES AND DIAZONIUM SALTS 15
Carboxylic acids and their derivatives
Carboxylic acids (aliphatic and aromatic)
Preparation: Acidic and Alkaline hydrolysis of esters.
Reactions: Hell – Voniard - Zelinsky Reaction.
Preparation: Acid chlorides Anhydrides Esters and Amides from acids and
their interconversion.
Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky
Reaction, Perkin condensation.
Amines and Diazonium Salts
Amines (Aliphatic and Aromatic): (Upto 5 carbons)
Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide
reaction.
Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO ₂ ,
Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration,
bromination, sulphonation.
Diazonium saits: Preparation: from aromatic amines.
IV AMINO ACIDS DEDTIDES AND DROTEINS AND CAPROHYDRATES 15
Amino Acids, Peptides and Proteins

Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis. Reactions of Amino acids: ester of -COOH group, acetylation of -NH2 group, complexation with Cu ²⁺ ions, ninhydrin test. Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C-terminal (thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C- activating groups and Merrifield solid-phase synthesis. Carbohydrates Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disacharrides (sucrose, cellobiose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation. Suggested Readings: 1. Barrow, G. M. Physical Chemistry Tata McGraw-Hill (2007). 2. Castellan, G. W. Physical Chemistry 3rd Ed. Narosa (1998). 3. Kotz, J. C., Treichel, P. M. & Townsend, J. R. General Chemistry, Cengage Learning India Pvt. Ltd.: New Delhi (2009). 4. Mahan, B. H. University Chemistry, 3rd Ed. Narosa (1998). 5. Petrucci, R.H. General Chemis									
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 structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disacharrides (sucrose, cellobiose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation. Suggested Readings: Barrow, G. M. Physical Chemistry Tata McGraw-Hill (2007). Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004). Kotz, J. C., Treichel, P. M. & Townsend, J. R. General Chemistry, Cengage Learning India Pvt. Ltd.: New Delhi (2009). Mahan, B. H. University Chemistry, 3rd Ed. Narosa (1998). Petrucci, R.H. General Chemistry, 5th Ed., Macmillan Publishing Co.: New York (1985). Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman. 		Classification, and General Properties, Glucose and Fructose (open chain and cyclic							
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 Petrucci, R.H. General Chemistry, 5th Ed., Macmillan Publishing Co.: New York (1985). Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman. 	4.	Mahan, B. H. University Chemistry, 3rd Ed. Narosa (1998).							
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 Education). 7. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 8. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 9. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman. 	6.	Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson							
 Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman. 		Education).							
 Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman. 	7.	Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).							
9. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.	8.	Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).							
	9.	Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.							

10. Berg, J. M., Tymoczko, J.L. & Stryer, L. Biochemistry, W.H. Freeman, 2002.

Course No:	Course Name: GE Lab: Solutions, Phase Equilibria, Conductance, Electrochemistry & Functional Group Organic Chemistry-liCourse Code: SBS CH 020202 GE 0042								
Batch:	Programme: Semester: L T P Credit Contact H						Contact Hr	s.	
2022 Onwards	022 Integrated B.Sc per Wei						per Week: Total Hrs:	04 60	
Total Evaluat	ion Marks: 50	Examination	n Duration:	6 Hrs					
CIE: 15 Ma	arks	Pre-requisite of course: Basic understanding of transition metals, coordination chemistry, kinetic theory of gases and chemical kinetics.							
Course	To provide studen	ts with basi	c concept o	of transitio	n/inner tra	nsition m	etals and b	ondina in	
Objective	coordination chemi	stry. Also get	idea about	various the	ories of rea	ction rates	5.	e	
Course	After completing th	is course, stu	ident is expe	ected to lea	arn the follo	wing:			
Outcomes:	CO1: Determine dis	nductance	istant						
	CO3: Understand p	otentiometri	c titrations						
	CO4: Determine qu	alitative or	ganic anal	ysis					
		CO	URSE SYL	LABUS					
NOTE:	will be set one from eas		The condidat		ired to attem	nt all the e	wastions		
Unit No.	will be set, one from eac	n of the UNIT.	Content	tes are requ : s	ired to atter	ipt all the c	luestions.	Contact	
		Hrs.							
I F	PHYSICAL CHEMISTRY	HYSICAL CHEMISTRY 30							
[Distribution	istribution							
5	tudy of the equilibriur	udy of the equilibrium of one of the following reactions by the distribution method:							
	2(aq) + I (aq) = I ₃ (aq)								
C	$Cu^{2+}(aq) + xNH_2(aq) = [Cu(NH_3)_x]^{2+}$								
F	Phase equilibria	o phase diag	ram of a b	inary syst	em (simple	eutectic)	using		
c	cooling curves								
t	b) Determination of the critical solution temperature and composition of the phenol								
	c) Study of the variation of mutual solubility temperature with concentration for the								
Ŕ	phenol water system and determination of the critical solubility temperature.								
C	Conductance								
((i) Determination of cell constant								
	(II) Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid								
((iii) Perform the following conductometric titrations: (a) Strong acid vs. strong base and								
(b) Weak acid vs. strong base								
F	Potentiometry								
139	Page	b potention		/13.					

	(ii) Strong acid vs. strong base	
	(iii) Weak acid vs. strong base	
	(iv) Potassium dichromate vs. Mohr's salt	
П	ORGANIC CHEMISTRY	30
	Systematic Qualitative Organic Analysis of Organic Compounds possessing	
	monorunctional groups (-COOR, phenolic, aldenyaic, ketonic, amide, nitro, amines) and preparation of one derivative	
	П	
	(i) Separation of amino acids by paper chromatography	
	(ii) Determination of the concentration of glycine solution by formylation method	
	(iii) Titration curve of glycine	
	(iv) Action of salivary amylase on starch	
	(v) Effect of temperature on the action of salivary amylase on starch	
	(vi) Differentiation between a reducing and a nonreducing sugar	
Suggested	Readings:	
1.	Vogel, A. I.; Tatchell, A. R.; Furnis, B. S.; Hannaford, A. J.; Smith, P. W. G. Textbook of Pra	ctical
Organic Ch	emistry, Prentice-Hall, 5 th ed, 1996.	
2.	Mann, F. G.; Saunders, B. C. Practical Organic Chemistry Orient-Longman, 1960.	
3.	Khosla, B. D.; Garg, V. C.; Gulati, A. Senior Practical Physical Chemistry, R. Chand & C	o.: New
Delhi (2012	1).	
4.	Ahluwalia, V.K.; Aggarwal, R. Comprehensive Practical Organic Chemistry, Universit	ies Press.

I

Course No:	Course Name:	Course Name: Course Code:							
	GE: Transition Me	GE: Transition Metal & Coordination Chemistry, SBS CH 020203 GE 4004							
	States of Matter &	s of Matter & Chemical Kinetics							
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact H	rs.	
2022	Integrated B.Sc						per Week	: 04	
Onwards	M.Sc. Chemistry	II	4	0	0	4	Total Hou	rs: 60	
Total Evalua	ation Marks: 100	Examinatio	n Duration:	3 Hrs.					
CIE: 30 M	Marks	Pre-requisite of course: Basic understanding of transition metals, coordination							
TEE: 70 N	⁄larks	chemistry, k	inetic theor	y of gases	and chemic	al kinetics.			
Course	To provide studen	ts with basi	c concept c	of transitic	on/inner tra	insition m	etals and l	bonding in	
Objective	coordination chemi	istry. Also get	idea about	various the	eories of rea	action rates	5.		
_		_							
Course	After completing th	is course, stu	dent is expe	ected to lea	arn the follo	owing:			
Outcomes:	CO1 : Understand cl	nemistry of a	and f block	elements					
	CO2 : Properties of	coordination	compounds	dination o	omnounds				
	CO4: Understandin	g CET for bon	ding in coor	dination of	ompounds				
	CO5: Understand th		deviation fr	om ideal h	ehaviour				
	CO6: Define rate of	reactions an	d the factor	s that affer	ct the rates	of chemica	l reactions		
							in reactions.		
COURSE SYLLABUS									
NOTE:									
i) Question	i) Question no. 1 is compulsory and to be set from the entire syllabus. It will have seven sub-parts and students								
need to ans	wer any four. Each part	carries three	and half ma	irks.					
ii) Question	nos. 2 to 5 are to be set	from all four	units one fr	om each.	Every quest	ion will hav	ve three sub	o-parts	
and students need to answer any two sub-parts of each question. Each part carries seven marks.									
Unit No.			Content	:S				Contact	
1								Hrs.	
•	General group trends	with specie	l reference	to elect	ronic confi	auration	variable	15	
	valoney colour magnetic and catalytic preparties, ability to form completes, and								
	stability of various oxidation states (Latimer diagrams) for Mp. Fe and Cu								
	stasinty of various oxidation states (Latiner diagrams) for with realid ed.								
	Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic								
	properties, lanthanide contraction, separation of lanthanides (ion exchange method								
	only).								
11	COORDINATION CHEM	ISTRY						15	
	Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu								
	(coordination numbers 4 and 6). Structural and stereoisomerism in complexes								
	with coordination numbers 4 and 6.								
	Drawbacks of VBT. IUPAC system of nomenclature.								

	CRYSTAL FIELD THEORY	
	Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal	
	field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the	
	magnitude of D. Spectrochemical series. Comparison of CFSE for O_h and T_d complexes,	
	Tetragonal distortion of octahedral geometry.	
	Jahn-Teller distortion, Square planar coordination.	
		15
	KINETIC THEORY OF GASES	15
	Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.	
	Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation	
	van der Waals equation of state for real gases. Boyle temperature (derivation not	
	required) Critical phenomenal critical constants and their calculation from van der Waals	
	equation Andrews isotherms of CO2	
	Maxwell Boltzmann distribution laws of molecular velocities and molecular energies and	
	their importance.	
	Temperature dependence of these distributions. Most probable, average and root mean	
	square velocities (no derivation). Collision cross section, collision number, collision	
	frequency, collision diameter and mean free path of molecules. Viscosity of gases	
	and effect of temperature and pressure on coefficient of viscosity (qualitative treatment	
	only).	
IV	CHEMICAL KINETICS	15
	The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors	
	on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate	
	equations for zero, first and second order reactions (both for equal and unequal	
	concentrations of reactants). Half–life of a reaction. General methods for determination	
	of order of a reaction. Concept of activation energy and its calculation from Arrhenius	
	equation.	
	Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular	
	reactions. Comparison of the two theories (qualitative treatment only).	
Suggest	ed Readings:	
1.	Barrow, G.M. Physical Chemistry Tata McGraw-Hill, 2007.	
2.	Castellan, G.W. Physical Chemistry 4 th Ed. Narosa, 2004.	
3.	Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).	
4.	Petrucci, R.H. General Chemistry 5th Ed. Macmillan Publishing Co.: New York, 1985.	
5.	Rodgers, G.E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.	
6.	Atkins, P. Paula, J. Atkins' Physical Chemistry, 10 th Edition. Oxford University Press, 2014.	

Course No:	Course Name: GE Lab: Transition Metal & Coordination				Course Code: SBS CH 020204 GE 0042						
	Kinetics										
Batch:	Programme:	amme: Semester: L T P Credit Contact Hrs.						s.			
2022 Onwards	Integrated B.Sc		0	0	4	2	per Week:	ek: 04			
Total Evaluati	M.Sc. Chemistry		0	0	4	Z	Total Hrs:	60			
	on Marks. 50	Examinatio	n Duration:	6 Hrs.							
CIE: 15 Ma	rks	Pre-requisite of course: Basic understanding of transition metals, coordination chemistry, kinetic theory of gases and chemical kinetics.									
Course	To provide studen	ts with hasi	r concent o	of transitio	n/inner_tra	insition m	etals and b	ondina in			
Objective	coordination chemi	stry. Also get	idea about	various the	eories of red	iction rate.	s.	shang hi			
Course Outcomes:	After completing this course, student is expected to learn the following: CO1: Analyze presence of acid and basic radicals CO2: Determine hardness of water CO3: Study reaction rates CO4: Measurement of surface tension and viscosity										
		CO	URSE SYL	LABUS							
NOTE:											
Two questions	will be set, one from eac	ch of the UNIT.	The candidat	tes are requ	ired to atter	npt all the c	questions.	Contact			
Unit No.		Contents Contact Hrs.									
I II S tr f(C A C ((() 1 n 2	INORGANIC CHEMISTRY30Semi-micro qualitative analysis (using H2S or other methods) of mixtures - not more than two ionic species (one anion and one cation, excluding insoluble salts) out of the following: Cations : NH4+, Pb2+, Bi3+, Cu2+, Cd2+, Fe3+, Al3+, Co2+, Ni2+, Mn2+, Zn2+, Ba2+, Sr2+, Ca2+, K+ Anions : CO32- , S2-, SO2-, S2O3-, NO3-, CH3COO-, Cl-, Br-, I-, NO3 , SO42-, PO43-, BO33-, C2O42-, F- (Spot tests should be carried out wherever feasible)301. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) or aluminium as oximate in a given solution gravimetrically. 2. Estimation of (i) Mg2+ or (ii) Zn2+ by complexometric titrations using EDTA.30							30			
II P (I a b (I a a b (I S	 (I) Surface tension measurement (use of organic solvents excluded). a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer. b) Study of the variation of surface tension of a detergent solution with concentration. (II) Viscosity measurement (use of organic solvents excluded). a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer. b) Study of the variation of viscosity of an aqueous solution with concentration of solute. (III) Chemical Kinetics Study the kinetics of the following reactions. 						30				

	 Initial rate method: Iodide-persulphate reaction Integrated rate method: Acid hydrolysis of methyl acetate with hydrochloric acid.
	3. Saponification of ethyl acetate.
Sugge	sted Readings:
1.	Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2.	Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3.	Khosla, B. D.; Garg, V. C. & Gulati, A. <i>Senior Practical Physical Chemistry,</i> R. Chand & Co.: New Delhi

(2011).
Course No:	Course Name: GE: Organometalli	Course Name: GE: Organometallics, Bioinorganic Cher				de: 0301 GE 4	004		
	Polynuclear Hydroc	arbons and L	JV, IR Spectr	oscopy					
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact H	rs.	
2022	Integrated B.Sc						per Week	:	04
Onwards	M.Sc. Chemistry		4	0	0	4	Total Hou	rs:	60
Total Evaluat	tion Marks: 100	Examinatio	n Duration:	3 Hrs.					
CIE: 30 M	arks	Pre-requisit	e of course	Basic und	lerstanding	of 3 <i>d</i> elem	nents, bondi	ing as	pects
TEE: 70 Ma	arks	in organom	etanic comp	ounds alor	ng with som	e spectros	copic paran	neters	5.
Course Objective	To provide organometallic/bio	To provide students with basic concept of bonding aspects in organometallic/bioinorganic/polynuclear compounds.							
Course Outcomes: NOTE: i) Question n	After completing th CO1 : Understand th important properti and potassium ferre CO2 : Use IR data to CO3 : Get a general CO4 : Understand th heterocyclic compor- reactions with under CO5 : Gain insight in CO6 : Use basic th functional group id o. 1 is compulsory and	his course, stu ne chemistry a es of the fam ocyanide explain the e idea about ro he fundamen bunds throug erlying mecha ho the basic f eoretical prin entification in to be set fror	adent is expe and applicati iliar compou extent of bac ole of metal tals of funct h the study anism fundamenta nciples unde course syl	ected to lea ions of 3d o unds potas ick bonding ions prese ional grou of metho l principles erlying UV plecules LABUS	arn the folic elements in ssium dichro g in carbony nt in biolog up chemistry ds of prepa s of IR and U '-visible and t will have s	owing: cluding the pmate, pot l complexe ical system y, polynuch aration, pro JV-Vis spect d IR spect	eir oxidation assium peri es lear hydroca operties and ctroscopic to roscopy as parts and st	arbon d che echnic a too udent	es and anate s and mical ques ol for
need to answ ii) Ouestion n	ver any four. Each part nos. 2 to 5 are to be set	carries three from all four	and half ma	rks. om each.	Everv auest	ion will ha	ve three sul	o-part	s
and students	need to answer any ty	vo sub-parts (of each ques	tion. Each	part carries	s seven ma	irks.		
Unit No.	·		Content	S				Con H	tact rs.
1 (CHEMISTRY OF 3d MET	ALS AND OR	GANOMETA	LLIC COM	IPOUNDS			1	.5
((/ F r	Chemistry of 3 <i>d</i> metal Oxidation states displa A study of the followin Peroxo compounds hitroprusside, [Co(NH ₃	s yed by Cr, Fe g compounds of Cr, K) ₆]Cl ₃ , Na ₃ [Co	, Co, Ni and 6 (including ₂ Cr ₂ O ₇ , Kl (NO ₂) ₆].	Co. preparatic VnO₄, k	on and impc (4[Fe(CN)6],	ortant prop sodium	perties); າ		
	Organometallic Compo	ounds							
[c z k	Definition and Classifi carbon bond (ionic, s Zeiss salt and ferron conding and properties	cation with 5, p and m cene. EAN ru 5 of mononuc	appropriate ulticentre l ule as applie lear and p	example bonds). S ed to carb olynuclear	s based or tructures o ponyls. Prep carbonyls	n nature of of methyl paration, s of 3d m	of metal- lithium, structure, netals. p-		

	acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).	
II	BIO-INORGANIC CHEMISTRY A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na ⁺ , K ⁺ and Mg ²⁺ ions: Na/K pump; Role of Mg ²⁺ ions in energy production and chlorophyll. Role of Ca ²⁺ in blood clotting, stabilization of protein structures and structural role (bones).	15
111	 POLYNUCLEAR AND HETERONUCLEAR AROMATIC COMPOUNDS AND ACTIVE METHYLENE COMPOUNDS Polynuclear/heteronuclear aromatic compounds Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Naphthalene, Anthracene, Furan, Pyrrole, Thiophene, and Pyridine. Active methylene compounds: Preparation: Claisen ester condensation. Keto-enol tautomerism. Reactions: Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having upto 6 carbon). 	15
IV	APPLICATION OF SPECTROSCOPY TO SIMPLE ORGANIC MOLECULES Application of visible, ultraviolet and infrared spectroscopy in organic molecules. Electromagnetic radiation, electronic transitions, $\lambda_{max} \& \varepsilon_{max}$, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes and α,β – unsaturated compounds. Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).	15

1. Huheey, J. E.; Keiter, E.; Keiter, R. *Inorganic Chemistry: Principles of Structure and Reactivity,* Pearson Publication.

- 2. Miessler, G. L.; Tarr, D. A. Inorganic Chemistry, Pearson Publication.
- 3. Lee, J. D. A New Concise Inorganic Chemistry, E.L.B.S.
- 4. Cotton, F. A.; Wilkinson, G. *Basic Inorganic Chemistry*, John Wiley & Sons.
- 5. Finar, I. L. Organic Chemistry (Vol. I & II), E.L.B.S.
- 6. Dyer, J. A. Applications of Absorption Spectroscopy of Organic Compounds, Prentice Hall.

7. Silverstein, R. M.; Bassler, G. C.; Morrill, T. C. *Spectroscopic Identification of Organic Compounds*, John Wiley & Sons.

- 8. Morrison, R. T.; Boyd, R. N. Organic Chemistry, Prentice Hall.
- 9. Sykes, P. A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
- 10. Bahl, A.; Bahl, B. S. Advanced Organic Chemistry, S. Chand.

Course No	: Course Name:	Course Name:				ode:		
	GE Lab: Organomet	allics, Bioin	organic Ch	emistry,	SBS CH 02	20302 GE	4004	
Batch:	Programme:	Semester:	L L	T	Р	Credit	Contact H	Irs.
2022	Integrated B.Sc						per Week	:: 04
Onwards	M.Sc. Chemistry	III	0	0	4	2	Total Hrs:	60
Total Evalu	ation Marks: 50	Examinatio	n Duration:	6 Hrs.				
CIE: 15 M	Marks	Pre-requisit	e of course	: Basic ur	nderstandin	g of metal	l-carbon bo	onds, metal
TEE: 35 M	Лarks	ions in biolo	ogy, hydroca	rbons and	spectrosco	oy.		
Course	To provide studen	ts with basi	c concept c	of transitio	on/inner tra	ansition m	etals and	bonding in
Objective	coordination chemistry. Also get idea about various spectroscopic techniques.							
Course	After completing th	is course, stu	dent is expe	ected to lea	arn the follo	owing:		
Outcomes:	CO1: Understandin	g of metal-ca Emotal ions in	rbon bond i biology	n chemistr	У			
	CO3: Understandin	g of enzymes	and proteir	IS				
	CO4: Synthesis of s	mple molecu	iles	-				
	CO5: And their char	racterizations	by UV and	IR spectros	сору			
		CC	URSE SYI	LABUS				
NOTE:				_				
Two question	ns will be set, one from eac	ch of the UNIT.	The candida	tes are requ c	ired to atter	npt all the q	uestions.	Contact
onit No.			content	.5				Hrs.
I	INORGANIC CHEMISTR	Y						30
	1. Separation of mixtu	res by chror	natography:	Measure	the Rf va	alue in ead	ch case.	
	(Combination of two io	ns to be givei	ר) ר = ³⁺ אל ³⁺	L C 3+				
	Paper chromatographic	separation c	of Fe ³⁺ , A1 ³⁺ ;	and Cr ^{on} or	7 2+			
	Paper chromatographic	separation c	following		Zn-	uromont	of thoir	
	conductivity:		TOHOWINg	complexes		Surement		
	a tetraamminecarbo	onatocobalt (III) nitrate					
	b. tetraamminecopp	er (II) sulpha	te					
	c. potassium trioxala	atoferrate (III) trihvdrate					
	Compare the conducta	nce of the cor	nplexes witl	n that of M	1/1000 solut	tion of NaC	Cl, MgCl ₂	
	and LiCl ₃ .							
II	ORGANIC CHEMISTRY							30
	Systematic Qualitativ	e Organic	Analysis	of Organ	ic Compo	unds pos	ssessing	
	monofunctional groups	s (-COOH, phe	enolic, aldeh	ydic, keto	nic, amide,	nitro, amir	nes) and	
	preparation of one der	ivative. Char	acterization	by UV and	l IR spectro	scopy.		

- 1. A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall, 7th Edn.
- 2. A.I. Vogel: Quantitative Chemical Analysis, Prentice Hall, 6th Edn.
- 3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
- 4. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.

Course No:	Course Name: Course Code: GE: Quantum Chemistry, Spectroscopy & SBS CH 020303 GE 4004 Photochemistry Photochemistry				4004				
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact H	rs.	
2022	Integrated B.Sc						per Week	:	04
Onwards	M.Sc. Chemistry	111	4	0	0	4	Total Hou	rs:	60
Total Evaluatio	n Marks: 100	Examinatio	n Duration:	3 Hrs.					
CIE: 30 Mar	ks	Pre-requisit	e of cour	se: Basic	understan	ding of	quantum i	mecha	anics,
TEE: 70 Marl	<s< td=""><td>molecular s</td><td>pectroscopy</td><td>and photo</td><td>ochemical re</td><td>eactions.</td><th></th><th></th><th></th></s<>	molecular s	pectroscopy	and photo	ochemical re	eactions.			
Course Objective	To provide student transition, quantun	s with basic n efficiency ar	concept of a nd photoche	quantum r mical proc	nechanics, esses.	bonding ir	n molecules,	, elect	ronic
Course Outcomes:	After completing this course, student is expected to learn the following: CO1: Understand basic principles of quantum mechanics: operators, eigen values, averages, probability distributions CO2: Understand chemical bonding in molecules CO3: Understand and use basic concepts of microwave, IR and UV-VIS spectroscopy for interpretation of spectra CO4: Understand the fundamentals of electron spin resonance CO5: Understanding fundamental of photophysical phenomena CO6: Define rate of reactions and the factors that affect the rates of chemical reactions								
		(
NOTE: i) Question no. need to answer ii) Question nos and students no	1 is compulsory and any four. Each part 5. 2 to 5 are to be set eed to answer any ty	to be set fror carries three from all four vo sub-parts o	n the entire and half ma units one fr of each ques	syllabus. I Irks. Tom each. I Stion. Each	t will have s Every quest part carries	even sub- ion will ha	parts and st ve three sub arks.	udent p-part	:S S
Unit No.	· ·		Content	:s				Con	tact
								Hr	ſS.
Po: and qu wa thr Qu up en An mc Rig tra	stulates of quantum i stulates of quantum i d its application to antization of energy vefunctions, probabi- ree dimensional boxe alitative treatment of of Schrödinger equi- ergy of diatomic mol gular momentum: omentum and z-comp gid rotator model nsformation to sphe	mechanics, que be free partic levels, zero- lity distributions, separation of simple harm ation and dis ecules and zero Commutation conent. of rotation erical polar	uantum mec cle and "p point energ on functions of variables nonic oscilla cussion of s ro-point en n rules, qu of diator coordinates	chanical op article-in-a y and Heis s, nodal pro s, degenera tor model solution ar ergy. antization nic moleo s. Separat	erators, Sch a-box" (rigo enberg Uno operties, Ext acy. of vibration d wavefun of square cule. Schrö cion of va	orödinger e prous trea certainty p tension to nal motion ctions. Vib of total dinger eq riables. S	equation atment), principle; two and : Setting prational angular quation, pherical	1	5

11	CHEMICAL BONDING Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H ²⁺ . Bonding and antibonding orbitals. Qualitative extension to H2. Comparison of LCAO-MO and VB treatments of H ₂ (only wavefunctions, detailed solution not required) and their limitations. Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB). Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH). Localised and non-localised molecular orbitals treatment of triatomic (BeH ₂ , H ₂ O) molecules. Qualitative MO theory and its application to AH2 type molecules.	15
111	 MOLECULAR SPECTROSCOPY Interaction of electromagnetic radiation with molecules and various types of spectra; Born- Oppenheimer approximation. Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution. Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches. Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion. Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model. 	15
IV	PHOTOCHEMISTRY Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.	15

1. Banwell, C. N. & McCash, E. M. *Fundamentals of Molecular Spectroscopy* 4th Ed. Tata McGraw-Hill: New Delhi, 2006.

2. Chandra, A. K. Introductory Quantum Chemistry Tata McGraw-Hill, 2001.

3. House, J. E. *Fundamentals of Quantum Chemistry* 2nd Ed. Elsevier: USA, 2004.

4. Lowe, J. P. & Peterson, K. *Quantum Chemistry*, Academic Press, 2005.

5. Kakkar, R. Atomic & Molecular Spectroscopy: Concepts & Applications, Cambridge University Press, 2015.

6. Rohatgi, K. K. Mukherjee, K. K. Fundamentals of Photochemistry, 3rd Edition. New Age International (P) Ltd., 2014.

Course No	: Course Name:		a .	0	Course C	ode:			
	GE Lab: Quantum	n Chemistry,	, Spectrosco	ору &	SBS CH 0	20304 GE	0042		
Batch	Programme:	Somostor:		т	D	Credit	Contact H	rc	
2022	Integrated B.Sc	Jennester.	L L	•	F	creat	per Week:	:	04
Onwards	M.Sc. Chemistry	Ш	0	0	4	2	Total Hrs:	6	50
Total Evalu	ation Marks: 50	Examinatio	n Duration:	6 Hrs.					
CIE: 15 M	Лarks								
TFF: 35 M	A arks	Pre-requisit	Pre-requisite of course: Knowledge of spectroscopy and colourimetry						
Course	To provide student	s with basic	concept of	quantum i	mechanics,	bonding in	molecules,	elea	ctronic
Objective	transition, quantun	n efficiency ai	nd photoche	mical proc	cesses.	_			
Course	After completing th	nis course, stu	ident is expe	ected to le	arn the follo	owing:	_		
Outcomes:	CO1 : Understand	basic princip	les of quar	ntum mec	hanics: ope	erators, eig	gen values,	ave	erages,
	CO2 : Understand c	hemical bond	ling in mole	cules					
	CO3: Understand	CO3: Understand and use basic concepts of microwave, IR and UV-VIS spectroscopy for							
	interpretation of sp	interpretation of spectra							
	CO4: Understand the fundamentals of electron spin resonance								
	CO6: Define rate of	reactions an	d the factor	s that affe	ct the rates	of chemica	al reactions.		
		CC	OURSE SYI	LABUS					
NOTE:									
			The second states						
Two question	ns will be set, one from eac	ch of the UNIT.	. The candida Content	tes are requ t s	uired to atter	mpt all the q	juestions.	Со	ntact
Two question Unit No.	ns will be set, one from eac	ch of the UNIT.	. The candida Content	tes are requ :s	uired to atter	npt all the q	juestions.	Coi F	ntact Irs.
Two questio Unit No.	ns will be set, one from eac UV/VISIBLE SPECTROS	ch of the UNIT.	. The candida Content	tes are requ t s	uired to atter	npt all the q	juestions.	Coi F	ntact Irs. 30
Two questio Unit No.	UV/VISIBLE SPECTROS i) Study the 200-500 nn determine the λ_{max} va	ch of the UNIT. COPY n absorbance alues. Calcula	The candida Content e spectra of l ate the ene	tes are requ t s <mno₄ an<br="">rgies of tl</mno₄>	uired to atter d K2Cr2O7 (ne two trar	mpt all the q in 0.1 M H ₂ nsitions in (uestions. SO4) and different	Cor	ntact Irs. 30
Two questio Unit No.	ns will be set, one from each one from each of the set, one from each of the set, one from each of the set o	ch of the UNIT. COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV	The candida Content e spectra of I ate the ene /).	tes are requ ts <mno₄ an<br="">rgies of tl trum (200</mno₄>	d K ₂ Cr ₂ O ₇ (the two tran	in 0.1 M H ₂ nsitions in G	SO4) and different	Cor	ntact Irs. 30
Two questio Unit No.	ns will be set, one from each of the set, o	ch of the UNIT. COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV dence of the nm UV spect	The candida Content e spectra of I ate the ene /). UV-Vis spec tra of the giv	tes are requ s <mno₄ an<br="">rgies of tl trum (200 ven compo</mno₄>	uired to atter d $K_2Cr_2O_7$ (ne two trar -500 nm) or bunds (acet	in 0.1 M H ₂ nsitions in G	SO4) and different	Coi	ntact Irs. 30
Two questio Unit No.	the set, one from each one from the set, one from each one for the set of	ch of the UNIT. COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV dence of the nm UV spect id) in water.	The candida Content e spectra of I ate the ene /). UV-Vis spec tra of the giv . Comment	tes are requ ts <mno₄ an<br="">rgies of th trum (200 ven compo con the e</mno₄>	uired to atter d K ₂ Cr ₂ O ₇ (ne two trar -500 nm) of punds (acet effect of st	in 0.1 M H ₂ nsitions in G f K ₂ Cr ₂ O ₇ . one, acetal ructure or	2SO4) and different ldehyde, n the UV	Cor	ntact Irs. 30
Two questio Unit No.	be set, one from each one from the set, one from each one for the set of t	ch of the UNIT. COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV dence of the nm UV spect id) in water. pounds.	The candida Content e spectra of I ate the ene /). UV-Vis spec tra of the giv . Comment	tes are requ ts <mno₄ an<br="">rgies of th trum (200 ven compo con the e</mno₄>	uired to atter d K ₂ Cr ₂ O ₇ (ne two trar -500 nm) of punds (acet effect of st	in 0.1 M H ₂ nsitions in o f K ₂ Cr ₂ O ₇ . one, acetal ructure or	2SO4) and different ldehyde, n the UV	Coi	ntact Irs. 30
Two questio Unit No.	be set, one from each one from the set of	ch of the UNIT. COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV dence of the nm UV spect id) in water. pounds.	The candida Content e spectra of I ate the ene /). UV-Vis spec tra of the giv . Comment	tes are requ ts <mno₄ an<br="">rgies of tl trum (200 ven compo con the e</mno₄>	d K ₂ Cr ₂ O ₇ (ne two trar -500 nm) of ounds (acet	in 0.1 M H ₂ nsitions in o f K ₂ Cr ₂ O ₇ . one, acetal ructure or	SO4) and different dehyde, n the UV	Cor	ntact Irs. 30
Two questio Unit No.	be set, one from each one from each one from each of the set, one from each of the set, one from each of the set, one from each of the set of	ch of the UNIT. COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV dence of the nm UV spect id) in water. pounds.	The candida Content e spectra of I ate the ene /). UV-Vis spec tra of the giv . Comment	tes are requ ts <mno₄ an<br="">rgies of th trum (200 ven compo con the e</mno₄>	uired to atter d K ₂ Cr ₂ O ₇ (ne two trar -500 nm) of punds (acet effect of st	in 0.1 M H ₂ nsitions in G f K ₂ Cr ₂ O ₇ . one, acetal ructure or	SO4) and different ldehyde, n the UV	Cor	ntact Irs. 30 30
Two questio Unit No.	UV/VISIBLE SPECTROS i) Study the 200-500 nm determine the λ_{max} va units (J molecule ⁻¹ , kJ m ii) Study the pH-depend iii) Record the 200-350 2-propanol, acetic ac spectra of organic com COLOURIMETRY i) Verify Lambe	ch of the UNIT. COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV dence of the nm UV spect id) in water. pounds. rt-Beer's	The candida Content e spectra of l ate the ene /). UV-Vis spec tra of the giv . Comment	tes are requ ts <mno₄ an<br="">rgies of th trum (200 ven compo trum compo on the e</mno₄>	d K ₂ Cr ₂ O ₇ (ne two trar -500 nm) or ounds (acet effect of st	in 0.1 M H ₂ nsitions in o f K ₂ Cr ₂ O ₇ . one, acetal ructure or the	uestions. SO4) and different Idehyde, n the UV	Con	ntact irs. 30
Two questio Unit No.	UV/VISIBLE SPECTROS i) Study the 200-500 nm determine the λ_{max} va units (J molecule ⁻¹ , kJ m ii) Study the pH-depend iii) Record the 200-350 2-propanol, acetic ac spectra of organic com COLOURIMETRY i) Verify Lambe concentration of CuSO ii) Determine the conce	COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV dence of the nm UV spect id) in water. pounds.	E spectra of l e spectra of l ate the ene /). UV-Vis spec tra of the giv . Comment law Cr ₂ O ₇ in a so	tes are requires $\langle MnO_4 \ an rgies \ of the first second seco$	d K ₂ Cr ₂ O ₇ (ne two tran -500 nm) of ounds (acet effect of st etermine unknown co	npt all the q in 0.1 M H ₂ nsitions in o f K ₂ Cr ₂ O ₇ . one, acetal ructure or the oncentratio	uestions. SO4) and different Idehyde, n the UV	Cor	ntact 1rs. 30 30
Two questio Unit No.	be set, one from each UV/VISIBLE SPECTROS i) Study the 200-500 nm determine the λ_{max} va units (J molecule ⁻¹ , kJ m ii) Study the pH-depend iii) Record the 200-350 2-propanol, acetic ac spectra of organic com COLOURIMETRY i) Verify Lambe concentration of CuSO ii) Determine the conce iii) Study the kinetics of	ch of the UNIT. COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV dence of the nm UV spect id) in water. pounds. rt-Beer's ₄/KMnO₄/K₂C entrations of f iodination o	The candida Content e spectra of I ate the ene /). UV-Vis spec tra of the giv . Comment law Cr ₂ O ₇ in a sc KMnO ₄ and of propanone	tes are requires $\langle MnO_4 \ an rgies of the rgies of the rgies of the rgies of the rgies on the equivalence on the equivalence on the rgies of the$	uired to atter d K ₂ Cr ₂ O ₇ (ne two trar -500 nm) of ounds (acet effect of st effect of st etermine unknown co a mixture. medium.	in 0.1 M H ₂ nsitions in o f K ₂ Cr ₂ O ₇ . one, acetal ructure or the oncentratio	SO4) and different Idehyde, n the UV	Cor	ntact Irs. 30
Two questio Unit No.	by will be set, one from each of the set of the	ch of the UNIT. COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV dence of the nm UV spect id) in water. pounds. rt-Beer's ₄/KMnO₄/K₂C entrations of f iodination o unt of iron pr	The candida Content e spectra of l ate the ene /). UV-Vis spec tra of the giv . Comment law Cr ₂ O ₇ in a sc KMnO ₄ and of propanone	tes are requires $\langle MnO_4 \ an rgies of the first second second$	uired to atter d K ₂ Cr ₂ O ₇ (ne two tran -500 nm) of ounds (acet effect of st etermine unknown co a mixture. medium. ng 1,10-phe	in 0.1 M H ₂ nsitions in o f K ₂ Cr ₂ O ₇ . one, acetal ructure or the oncentratio	uestions. SO4) and different Idehyde, n the UV	Cor	ntact 1rs. 30 30
Two questio Unit No.	UV/VISIBLE SPECTROS i) Study the 200-500 nm determine the λ_{max} va units (J molecule ⁻¹ , kJ m ii) Study the pH-depend iii) Record the 200-350 2-propanol, acetic ac spectra of organic com COLOURIMETRY i) Verify Lambe concentration of CuSO ii) Determine the conce iii) Study the kinetics of iv) Determine the amount v) Determine the disson	ch of the UNIT. COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV dence of the nm UV spect id) in water. pounds. rt-Beer's ₄/KMnO₄/K₂C entrations of f iodination o unt of iron pr ciation consta	Expectra of I ate the ene /). UV-Vis spec tra of the giv . Comment Iaw Cr ₂ O ₇ in a so KMnO ₄ and of propanone resent in a so ant of an inc	tes are requires $\langle MnO_4 \ an rgies of the rgies of the rum (200) \langle en \ composed (200) \\\langle en \ composed (200$	d K ₂ Cr ₂ O ₇ (ne two tran -500 nm) of ounds (acet effect of st etermine unknown co a mixture. medium. ng 1,10-phe ienolphthal	npt all the q in 0.1 M H ₂ nsitions in o f K ₂ Cr ₂ O ₇ . one, acetal ructure or the oncentratio	uestions. 2SO4) and different Idehyde, n the UV	Cor	ntact Irs. 30
Two questio Unit No.	UV/VISIBLE SPECTROS i) Study the 200-500 nm determine the λ_{max} va units (J molecule ⁻¹ , kJ m ii) Study the pH-depend iii) Record the 200-350 2-propanol, acetic ac spectra of organic com COLOURIMETRY i) Verify Lambe concentration of CuSO ii) Determine the conce iii) Study the kinetics of iv) Determine the amount v) Determine the disso vi) Study the kinetics	ch of the UNIT. COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV dence of the nm UV spect id) in water. pounds. rt-Beer's ₄/KMnO₄/K₂C entrations of f iodination o unt of iron pr ciation consta of interactio	The candida Content e spectra of I ate the ene /). UV-Vis spec tra of the giv . Comment Iaw Cr ₂ O ₇ in a sc KMnO ₄ and of propanone resent in a sc ant of an income on of crysta	tes are requires $\langle MnO_4 \ an rgies \ of the first second seco$	d K ₂ Cr ₂ O ₇ (ne two tran -500 nm) of ounds (acet effect of st effect of st etermine unknown co a mixture. medium. ng 1,10-phe penolphthal ohenolphtha	npt all the q in 0.1 M H ₂ nsitions in o f K ₂ Cr ₂ O ₇ . one, acetal ructure or the oncentratio mathroline. ein). alein with	Udestions. (SO4) and different Idehyde, n the UV	Cor	ntact Irs. 30
Two questio Unit No.	UV/VISIBLE SPECTROS i) Study the 200-500 nm determine the λ_{max} va units (J molecule ⁻¹ , kJ m ii) Study the pH-depend iii) Record the 200-350 2-propanol, acetic ac spectra of organic com COLOURIMETRY i) Verify Lambe concentration of CuSO ii) Determine the conce iii) Study the kinetics of iv) Determine the amou v) Determine the disso vi) Study the kinetics hydroxide. vii) Analyse the given vi	ch of the UNIT. COPY n absorbance alues. Calcula nol ⁻¹ , cm ⁻¹ , eV dence of the nm UV spect id) in water. pounds. rt-Beer's ₄/KMnO₄/K₂C entrations of f iodination o unt of iron pr ciation consta of interactio ibration-rota	E spectra of l ate the ene /). UV-Vis spec tra of the giv . Comment law Cr ₂ O ₇ in a sc KMnO ₄ and of propanone resent in a sc ant of an inco on of crysta	tes are requires $\langle MnO_4 \ an rgies of the first second second$	d K ₂ Cr ₂ O ₇ (ne two tran -500 nm) of ounds (acet effect of st etermine unknown co a mixture. medium. ng 1,10-phe benolphthal ohenolphtha	npt all the q in 0.1 M H ₂ nsitions in o f K ₂ Cr ₂ O ₇ . one, acetal ructure or the oncentratio	uestions. 2SO4) and different Idehyde, n the UV on sodium	Cor	ntact 1rs. 30 30

1. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

2. Khosla, B. D.; Garg, V. C. & Gulati, A., *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).

3. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry* 8th Ed.; McGraw-Hill: New York (2003).

4. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.: New York (2003).

Course No:	Course Name: Course Code:								
	GE: Molecules of Li	fe	Γ	1	SBS CH 02	0401 GE 4	004		
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact H	rs.	
2022	Integrated B.Sc						per Week	•	04
Onwards	M.Sc. Chemistry	IV	4	0	0	4	Total Hou	rs:	60
Total Evalu	ation Marks: 100	Examinatio	n Duration:	3 Hrs.					
CIE: 30 f	Marks								
TEE: 70 M	Marks	Pre-requisit	e of course	Basic und	erstanding	of biologic	al processes	5.	
Course Objective	To provide students	s with basic co	oncept of bi	ological pr	ocesses and	energy in	biosystem.		
Course	After completing th	After completing this course, student is expected to learn the following:							
Outcomes:	CO1: Learn and d	emonstrate	how the st	ructure o	f biomolec	ules deter	mines thei	r che	emical
	properties, reactivi	ty and biologi	cal uses						
	CO2: Gain an insigh	it into mecha	nism of enzy	/me action	and inhibit	ion			
	CO3: Understand th	ne basic princ	iples of dru	g-receptor	interaction	and SAR			
	CO4: Understand biological processes like replication, transcription and translation								
	CO5: Demonstrate an understanding of metabolic pathways, their inter-relationship, regulation and								
	CO6: To understand	d concept of a	ncal proces	sustems					
			COURSE SVI						
				LADOJ					
NOTE:									
I) Question	no. 1 is compulsory and	to be set from	n the entire	syllabus. I	t will have s	seven sub-	parts and st	uden	ts
need to ans	wer any four. Each part	carries three	and nait ma	irks.		المعربين	va thraa cul		+-
and studen	ts need to answer any tw	vo sub-parts (units one n	om each.	nart carrier	ION WIII Nd	ve three sut	э-раг	lS
Unit No.			Content	s	pure curre.	5500000	11.5.	Cor	ntact
				-				Н	irs.
I	CARBOHYDRATES							1	15
	Classification of carbo	hvdrates, red	lucing and	non-reduci	ing sugars.	General p	properties		
	of glucose and fructose	their open c	hain struct	ure. Fnime	ers, mutarot	ation and a	anomers		
	Determination of confi	guration of G	lucose (Fisc	her proof).				
	Cyclic structure of gluc	ose. Haworth	projection	s. Cvclic st	ructure of f	ructose.			
	Linkage between mo	nosachharide	s, structur	e of disa	acharrides	(sucrose,	maltose,		
	lactose) and polysacha	rrides (starch	and cellulo	se) exclud	ing their str	ucture elu	icidation.		
		·		,	C				
II	AMINO ACIDS, PEPTID	ES AND PROT	EINS					1	15
	Classification of Amino	Acids, Zwitte	rion structu	re and Isoe	electric poin	it.			
	Overview of Primary,	Secondary,	of poptidos	na Quate	ernary stru	cture of	proteins.		
	(by DNEP, and Edma	ary structure	d C tormin	, determin al amino a	ation of N-t	erminal ar bydantoin	and with		
	carboyypentidase enzy	(me) Synthe	u u-lermin sis of sim	nle nenti	ciu (Dy LIIIO des (unto	dinentide	s) by N_{-}		
	nrotection (t- hutvlovy	rarhonvl and	nhthalovI) S	VC-activat	ing groune	and Morri	field solid		
	phase synthesis		pricial oyi) (me er oups				

ш	ENZYMES AND CORRELATION WITH DRUG ACTION, AND NUCLEIC ACIDS	15
	Enzymes and correlation with drug action Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition(Competitive and Non- competitive inhibition including allosteric inhibition). Drug action-receptor theory. Structure –activity relationships of drug molecules, binding role of –OH group,-NH2 group, double bond and aromatic ring.	
	Nucleic Acids Components of nucleic acids: Adenine, guanine, thymine and Cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.	
IV	LIPIDS AND CONCEPT OF ENERGY IN BIOSYSTEMS	15
	Lipids Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, lodine number. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).	
	Concept of Energy in Biosystems Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate- Glycolysis, Fermentation, Krebs Cycle. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates.	
Suggested	Readings:	
1. Mo 2. Fir 3 Fir	prrison, R. T.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson nar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson nar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson	Education). Education). Education)
4. Ne	lson, D. L.; Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.	Laucacionj.

Neison, D. L.; Cox, M. M. Leminger's Principles of Biochemistry 7th Ed., V
 Berg, J. M. Tymoczko, J.L. & Stryer, L. Biochemistry, W.H. Freeman, 2002.

GE Lab: Molecules of Life SBS CH 020402 GE 0042 Batch: Programme: Semester: L T P Credit Contact Hrs. 2022 Integrated B.Sc Integrated B.Sc IV 0 0 4 2 Total Hrs: Total Evaluation Marks: 50 Examination Duration: 6 Hrs. Pre-requisite of course: Basic understanding of paper chromato saponification Value titration Synthesis And Extraction DN/	04 60						
Batch: 2022Programme: Integrated B.Sc OnwardsSemester: 	04 60						
2022 Integrated B.Sc per Week: Onwards M.Sc. Chemistry IV 0 0 4 2 Total Hrs: Total Evaluation Marks: 50 Examination Duration: 6 Hrs. Pre-requisite of course: Basic understanding of paper chromato saponification, value, titration, synthesis, and Extraction, of DNA	04 60						
OnwardsM.Sc. ChemistryIV0042Total Hrs:Total Evaluation Marks: 50Examination Duration:6 Hrs.CIE:15 MarksPre-requisite of course:Basic understanding of paper chromato saponification value titration synthesis and Extraction of DNA	60						
Total Evaluation Marks: 50Examination Duration: 6 Hrs.CIE: 15 MarksPre-requisite of course: Basic understanding of paper chromato saponification value titration synthesis and Extraction of DNA							
CIE: 15 Marks Pre-requisite of course: Basic understanding of paper chromato saponification value titration synthesis and Extraction of DNA							
saponification value, titration, synthesis and Extraction of							
TEE: 35 Marks onion/cauliflower.							
Course To provide students with basic concept of synthesis of medicinal compounds and	l paper						
Objective chromatography. Also determination of saponification/concentration of some given sample	2.						
Course After completing this course, student is expected to learn the following:	After completing this course, student is expected to learn the following:						
Outcomes: CO1: To understand paper chromatography in separation of amino acids	CO1: To understand paper chromatography in separation of amino acids						
CO2 : Determine saponification value	CO2 : Determine saponification value						
CO4: Synthesis of some medicinal compounds							
COURSE SYLLABUS							
NOTE:							
I wo questions will be set, one from each of the UNIT. The candidates are required to attempt all the questions.	ontact						
contents contents	Hrs.						
I INORGANIC CHEMISTRY	30						
1. Separation of amino acids by paper chromatography							
2. To determine the concentration of glycine solution by formylation method.							
3. Study of titration curve of glycine							
4. Action of salivary amylase on starch							
5. Effect of temperature on the action of salivary amplase on starch.							
II ORGANIC CHEMISTRY	30						
1. To determine the saponification value of an oil/fat.							
2. To determine the iodine value of an oil/fat							
3. Differentiate between a reducing/nonreducing sugar.							
4. Extraction of DNA from onion/cauliflower							
5. To synthesise aspirin by acetylation of salicylic acid and compare it with							
the ingredient of an aspirin tablet by TLC.							
Suggested Readings:	Practical						
1. Furniss, B. S.; Hannaford, A. J.; Rogers, V.; Smith, P. W. G.; Tatchell, A. R. Vogel's Textbook of Practic							
Organic Chemistry, ELBS.							
Organic Chemistry, ELBS.							

Course No:	Course Name:Course Code:GE: Chemistry of Main Group Elements, Theories of Acids and BasesSBS CH 020403 GE 400					004				
Batch:	Programme:	Semester:	L	Т	Р	Credit	Contact H	rs.	_	
2022 Opwards	Integrated B.Sc	11/	1	0	0	4	per Week	04 rev 60	4	
Total Evaluati	ion Marks: 100	IV	4	0	0	4		15. 00	,	
		Examinatio	n Duration:	3 Hrs.						
CIE: 30 Ma	ırks		_		_					
TFF· 70 Ma	rks	Pre-requisit	Pre-requisite of course: Basic properties of acid-base and <i>s/p</i> -block elements.							
Course Objective	<i>To provide students with basic concept of</i> periodic properties and bonding aspects in molecules.									
Course	After completing th	nis course, stu	dent is expe	ected to lea	arn the follo	owing:				
Outcomes:	CO1: To understand acid base interaction									
	CO3 : To understand the basic principles of periodic properties of s/ <i>n</i> -block elements									
	CO4: To understand multicentre bonding in boranes									
	CO5: Understanding of inorganic polymers									
	CO6: To understand	d concept of p	oseudohalid	es						
		0	COURSE SYL	LABUS						
NOTE:	A									
I) Question no	b. 1 is compulsory and	to be set from	n the entire	syllabus. I	t will have s	seven sub-	parts and sti	udents		
ii) Question n	os. 2 to 5 are to be set	from all four	units one fi	rom each. I	Every quest	ion will ha	ve three sub	-parts		
and students	need to answer any tw	vo sub-parts o	of each ques	stion. Each	part carries	s seven ma	arks.	•		
Unit No.			Content	S				Contac Hrs	:t	
I A	CIDS AND BASES, GE	NERAL PRINC	IPLES OF M	ETALLURG	6Y			115		
A	cids and Bases									
В	rönsted–Lowry conce	ept, conjugat	e acids and	bases, re	lative stren	gths of ac	cids and			
b	ases, effects of subst	ituent and so	olvent, diffe	rentiating	and levellin	ng solvent	s. Lewis			
a	cid-base concept, cia	t Hard and s	r Lewis aci oft acids an	ds and ba d hases (H	ISES, LUX-FI SAB concer	000 conce ot) applica	ept and			
H	ISAB process.			0 00303 (11						
G	eneral Principles of I	Metallurgy	notale has	d on sta	ndard ala	strada sa	tontials			
E	llingham diagrams f	or reduction	n of meta	l oxides	using car	bon and	carbon			
n n	nonoxide as reducing	g agents.		-						
	lydrometallurgy with	reterence to	o cyanide pr	ocess for	gold and	silver.	Viethods			
0	i purification of met	dis (Al, PD, I Soer process	Parting Pro	ινι, ΖΠ, Αυ Γρες Μοη	d's process	and Kroll	Ig, zone			
					process					

II	s- AND p-BLOCK ELEMENTS	15
	Periodicity in s- and n-block elements with respect to electronic configuration atomic	
	and ionic size, ionization enthalpy, electron gain enthalpy, electronegativity (Pauling	
	scale).	
	General characteristics of s-block metals like density, melting and boiling points,	
	flame colour and reducing nature.	
	Oxidation states of s- and p-block elements, inert-pair effect, diagonal relationships and	
	anomalous behaviour of first member of each group. Allotropy in C, P and S.	
	Complex forming tendency of <i>s</i> block elements and a preliminary idea of crown ethers	
	and cryptates, structures of basic beryllium acetate, salicylaldehyde/ acetylacetonato	
	complexes of Group 1 metals.	
	Solutions of alkali metals in liquid ammonia and their properties.	
	superovides, such as ease of formation, solubility and stability of oxides, perovides,	
	superoxides, suprates and carbonates of s block metals.	
Ш	Structure, bonding and properties	15
	Diborane and concept of multicentre bonding, hydrides of Groups 13 (EH3), 14, 15, 16 and	
	17. Ovides of N and P. Ovoacids of P. S and Cl	
	Halides and exohalides of P and S (PCl_3 , PCl_5 , $SOCl_2$ and SO_2Cl_2). Interhalogen compounds,	
	A brief idea of pseudohalides	
IV	NOBLE GASES AND INORGANIC POLYMERS	15
	Noble gases	
	Rationalization of inertness of noble gases, clathrates, preparation and properties of XeE and XeE bonding in these compounds using VBT and shapes of noble gas	
	compounds using VSEPR Theory.	
	Inorganic Polymers	
	Types of inorganic polymers and comparison with organic polymers, structural features,	
	classification and important applications of silicates. Synthesis, structural features	
	properties and reactions. Bonding in $(NPCl_3)_2$.	
Suggested	Readings:	
1. Lee	e, J. D. Concise Inorganic Chemistry ELBS, 1991.	
2. Cot	tton, F. A.; Wilkinson, G.; Gaus, P. L. Basic Inorganic Chemistry, 3rd ed. Wiley.	
3. Do	uglas, B. E.; McDaniel, D. H.; Alexander, J. J. Concepts and Models in Inorganic Chemistry,	John Wiley
4 C-ra	enwood N N·Farnshaw Chemistry of the Flements Butterworth-Heinemann 1997	
5 Ro	dger G E Inorganic and Solid State Chemistry Cengage Learning India Edition 2002	
6. Mi	essler, G. L.: Tarr. D. A. Inorganic Chemistry 4th Ed. Pearson, 2010.	
7. Atl	xin, P.; Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press 2010.	

Course No:	Course Name: GE Lab: CHEMIS THEORIES OF ACIDS	TRY OF MAIN S AND BASES	GROUP ELE	MENTS,	Course C SBS CH 0	Code: 20404 GE	0042	
Batch:	Programme:	Semester:	L	т	Р	Credit	Contact Hr	·s.
2022 Onwards	Integrated B.Sc	IV	0	0	1	2	per weeк: Total Hrs:	60
Total Evaluatio	Marks: 50	10	0	0	4	2	Total III.	00
	Ji Warks. 50	Examinatio	n Duration:	6 Hrs.				
CIE: 15 Mar TEE: 35 Mar	ks ks	Pre-requisit synthesis of	e of course some inorg	e: Basic anic comp	understand llexes.	ing of qua	antitative an	alysis and
Course Objective	To provide studen determination of d	ts with basic issolved oxyg	c concept o en in water	f iodomet sample.	tric estimat	<i>tion,</i> gravir	netric estim	ation and
Course Outcomes:	CourseAfter completing this course, student is expected to learn the following:Outcomes:CO1: To understand iodometric estimationCO2: To understand gravimetric estimationCO3: Determination of dissolved oxygen in water samplesCO4: Synthesis of some inorganic complexes							
		CO	URSE SYI	LABUS				
NOTE:								
Two questions w	vill be set, one from eac	ch of the UNIT.	The candida	tes are requ	uired to atte	mpt all the c	questions.	Contact
onic ito.			content	.5				Hrs.
I IN	ORGANIC CHEMISTR	Y						30
1.1 2.1 3.1 ble 4. 5.	 Iodometric estimation of potassium dichromate and copper sulphate Iodimetric estimation of antimony in tartaremetic Estimation of amount of available chlorine in bleaching powder and household bleaches Estimation of iodine in iodized salts. 					usehold		
II OF	RGANIC CHEMISTRY							30
1. 2. 3. 4. su sa	 Estimation of dissolved oxygen in water samples. Gravimetric estimation of sulphate as barium sulphate. Gravimetric estimation of aluminium as oximato complex Preparation of the following: potash alum, chrome alum, tetraamminecopper(II) sulphate monohydrate, potassium trioxalatoferrate(III) (any two, including one double salt and one complex) 							
Suggested Rea	dings:		nalucia D		ation 2012		i	
1. Svenia, 2. Mendr	, G. vogei s Qualitativ iam, J. Vogel's Quant	itative Chemi	cal Analysis, Pea	, Pearson,	2009.	•		

5. TEACHING-LEARNING PROCESS

- Lectures
- Discussions
- Simulations
- Role Playing
- Participative Learning
- Interactive Sessions
- Seminars
- Research-based Learning/Dissertation or Project Work
- Technology-embedded Learning
- Hands on training
- Self study analysis
- Report writing

6. IMPLEMENTATION OF BLENDED LEARNING

Blended Learning is a pedagogical approach that combines face to-face classroom methods with computer-mediated activities in the process of teaching and learning. It implies nice blend of face-to-face and online activities to make the learning processes more interesting and engaging. It focuses on integration of traditional classroom activities and innovative ICT-enabled strategies. It emphasizes student-centric learning environment where the teacher is the facilitator for productive and measurable learning outcomes. It optimizes and compliments the face to face learning, giving ample freedom and flexibility to the students and teachers to access and explore the wide range of openaccess sources such as video lectures, podcasts, recordings and articles through digital platforms. It gives freedom and autonomy to the teachers in selection of appropriate digital platforms, resources and time-slots to complement and supplement face to face learning. The Blended Learning doesn't undermine the role of the teacher, rather it gives him/her an opportunity to explore the unexplored in accordance with the requirements of the curriculum.

Key features of Blended Learning

- Student-Centric Pedagogical Approach focusing on flexibility in timing, quality content, needs and interests of students and freedom to study through the mode of his/her choice;
- Freedom to Select variety of mediums and techniques;
- Increased student engagement in learning;
- Enhanced teacher and student interaction;
- Improved student learning outcomes;
- More flexible teaching and learning environment;
- More responsive for self and continuous learning;
- Better opportunities for experiential learning;
- Increased learning skills;
- Greater access to information, improved satisfaction and learning outcomes.

Note: It was resolved that Blended Learning with 40% component of online teaching and 60% face to face classes for each programme, may be adopted

7. ASSESSMENT AND EVALUATION

Overall assessment will be made as per relevant ordinances of CUH.

- Continuous Comprehensive Evaluation at regular after achievement of each Course-level learning outcome
- Formative Assessment on the basis of activities of a learner throughout the programme instead of one-time assessment
- Oral Examinations to test presentation and communication skills
- Open Book Examination for better understanding and application of the knowledge acquired if required
- Group Examinations on Problem solving exercises
- Seminar Presentations
- Review of Literature
- Collaborative Assignments

8. REFERENCES

- Instructional Template for Facilitating Implementation of Choice Based Credit System (CBCS) (<u>https://www.ugc.ac.in/pdfnews/4426331 Instructional-</u> <u>Template.pdf</u>)
- Scheme and Syllabi of B. Sc. Honours with chemistry (https://www.ugc.ac.in/pdfnews/6573215_B.Sc.HONOURS-CHEMISTRY.pdf)
- Scheme and Syllabi of B. Sc. with chemistry (<u>https://www.ugc.ac.in/pdfnews/0614691_LOCF-chemistry.pdf</u>)
- National Education Policy-2020. <u>https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0</u> .pdf
- The draft subject specific LOCF templates available on UGC website. <u>https://www.ugc.ac.in/ugc notices.aspx?id=MjY500</u>==
- Draft Blended Mode of Teaching and Learning: Concept Note available on UGC website. <u>https://www.ugc.ac.in/pdfnews/6100340 Concept-Note-Blended-Mode-of-Teaching-and-Learning.pdf</u>
- Guidelines for Multiple Entry and Exit in Academic Programmes offered in Higher Education Institutions (<u>https://www.ugc.ac.in/e-book/GL%20Multipe%20Entry%20Exit/mobile/index.html</u>)

9. APPENDICES

• Curricular Reforms — Extracts from National Education Policy-2020