RANI CHANNAMMA UNIVERSITY, BELAGAVI

PROGRAM /COURSE STRUCTURE AND SYLLABUS

As per the Choice Based Credit System (CBCS) designed in accordance with Learning Outcomes-Based Curriculum Framework (LOCF) of National Education Policy (NEP) 2020

for

Bachelor of Science (Basic/Hons)
Chemistry (Revised)

Effective from Academic Year 2021-22 and onwards

RANI CHANNAMMA UNIVERSITY, BELAGAVI

BSc (Basic / Hons) Chemistry program-2021-22

BoS Committee-NEP-BSc (Hons) Chemistry

S.No.	Name & Address	Designation
1	Prof. K. Kantharaju Chairman & Professor, Dept. of Chemistry RCUB	**Chairman**
2	Dr. Abhay Kulkarni B.K. College, Belagavi.	**Member**
3	Dr. Vasulkar B.K. College, Belagavi.	**Member**
4	Dr. A.S. Jaganure KLEs, GIBASC college Nippani-37.	**Co-opted Members**
5	Dr. S.M.Deshpande GSS College, Tilakwadi Belagavi-06.	**Co-opted Members**

PREAMBLE

The objective of any programme at Higher Education Institute is to prepare their students for the society at large. The Rani Channamma University envisions all its programmes in the best interest of their students and in this endeavour, it offers a new vision to all its Under-Graduate courses. It embedded Learning Outcome-based Curriculum Framework (LOCF) for all its Under Graduate programmes.

The LOCF approach is envisioned to provide a focused, outcome-based syllabus at the undergraduate level with an agenda to structure the teaching-learning experiences in a more student-centric manner. The LOCF approach has been adopted to strengthen students' experiences as they engage themselves in the programme of their choice. The Under-Graduate Programmes will prepare the students for both, academia and employability.

Each programme vividly elaborates its nature and promises the outcomes that are to be accomplished by studying the courses. The programmes also state the attributes that it offers to inculcate at the graduation level. The graduate attributes encompass values related to well-being, emotional stability, critical thinking, social justice and also skills for employability. In short, each programme prepares students for sustainability and life-long learning.

The new curriculum of BSc (Hons) Chemistry offer courses in the areas of inorganic, organic, physical, industrial, materials and analytical. All the courses are having defined objectives and Learning Outcomes, which will help prospective students in choosing the elective courses to broaden their skills in the field of chemistry and interdisciplinary areas. The courses will train students with sound theoretical and experimental knowledge that suits the need of academics and industry. The course also offers ample of skills to pursue research as career in the field of chemistry and allied areas. As usual, B.Sc (Hons) Chemistry programme offered will continue to produce best minds to meet the demands of society.

The Rani Channamma University hopes the LOCF approach of the programme BSc (Hons) Chemistry will help students in making an informed decision regarding the goals that they wish to pursue in further education and life, at large.

Syllabus & Regulations Governing the Choice-Based Credit System (CBCS) for the Four-Year (Eight Semesters) B.Sc (Hons) Chemistry Program

Introduction to B.Sc (Hons.) Chemistry

The Choice Based Credit System (CBCS) provides an opportunity to a student to choose courses from the syllabus comprising Core, Elective, Vocational and Skill based courses. It offers a flexibility of programme structure while ensuring that the student gets a strong foundation in the subject and gains in-depth knowledge. The learning outcome based curriculum framework (LOCF) will provide students with a clear purpose to focus their learning efforts and enable them to make a well judged choice regarding the course they wish to study. This will suit the present day needs of students in terms of securing their paths towards higher studies or employment.

Programme Structure

Discipline Specific Core (DSC) Courses: First, second, third and fourth semesters will have one DSC course in each semester. Every DSC course has 6 credits and a practical component (4 credits for theory and 2 credits for practical).

Fifth and sixth semesters will have two Discipline Specific Core (DSC) courses in each semester. Every DSC course has 5 credits and has practical component (3 credits for theory and 2 credits for practical).

Seventh and eighth semesters will have three Discipline Specific Core (DSC) courses in each semester, three DSC courses have 6 credits each (4 credits for theory and 2 credits for practical).

Open Elective (OE) Courses: First, second, third and fourth semesters will have one OE course in each semester. Every OE course has 3 credits and with no practical component. OE courses are for other subject students (other than major and minor), and the candidate has to choose one OE from the each semester.

Vocational Courses: Fifth and sixth semester will have one each vocational courses of each 3 credits. In sixth semester students have 2 credits internship course (usually on research related work (basic knowledge about research, how to start, literature, journals, reviews and more can be taught and ask students to do and submit a final report for assessment). These courses can enable students to obtain the required basic research insights knowledge along with online resource or practical skills.

Discipline Specific Elective (DSE) Courses: Seventh and eighth semesters will have two DSE courses. In seventh semester will have one research methodology (3 credits) and another spectroscopy to meet the equivalence of first year master degree (4 credits).

In eighth semester again one DSE 4 credits theory and another research project for 4 credits need to perform one semester project work by selecting suitable problems by the mentors.

PROGRAMME OUTCOME from B.Sc (Hons.) Chemistry

The B.Sc.(Hons) programme in Chemistry is designed to develop in students in depth knowledge of the core concepts and principles that are central to the understanding of this core science discipline. Undergraduates pursuing this programme of study go through laboratory work that specifically develops their quantitative and qualitative skills, provides opportunities for critical thinking and team work, and exposes them to techniques useful for applied areas of scientific study.

- **Knowledge: Width and depth:**

  Students acquire theoretical knowledge and understanding of the fundamental concepts, principles and processes in main branches of chemistry, namely, organic, inorganic, physical, spectroscopy, analytical and biochemistry. In depth understanding is the outcome of transactional effectiveness and treatment of specialized course contents. Width results from the choice of electives that students are offered.

- **Laboratory Skills: Quantitative, analytical and instrument based:**

  A much valued learning outcome of this programme is the laboratory skills that students develop during the course. Quantitative techniques gained through hands on methods opens choice of joining the industrial laboratory work force early on. The programme also provides ample training in handling basic chemical laboratory instruments and their use in analytical and biochemical determinations. Undergraduates on completion of this programme can cross branches to join analytical, pharmaceutical, material testing and biochemical labs besides standard chemical laboratories.

- **Communication:**

  Communication is a highly desirable attribute to possess. Opportunities to enhance students' ability to write methodical, logical and precise reports are inherent to the structure of the programme. Techniques that effectively communicate scientific chemical content to large audiences are acquired through oral and poster presentations and regular laboratory report writing.

- **Capacity Enhancement:**

  Modern day scientific environment requires students to possess ability to think independently as well as be able to work productively in groups. This requires some degree of balancing. The chemistry honours programme course is designed to take care of this important aspect of student development through effective teaching learning process.

- **Portable Skills:**

  Besides communication skills, the programme develops a range of portable or transferable skills in students that they can carry with them to their new work environment after completion of chemistry honours programme. These are problem solving, numeracy and mathematical skills- error analysis, units and conversions, information retrieval skills, IT skills and rganizational skills. These are valued across work environments.

Structure of the Programme in B.Sc (Hons.) Chemistry

The programme includes Core Courses and Elective Courses. The Core Courses are all compulsory courses (DSC). There are three types of Elective Courses – Discipline Specific Elective (DSE), Open Elective (OE), and Skill Enhancement Courses (SEC), have sub skill based and value based. In addition there are two compulsory Ability Enhancement Courses (AECC). The Core, DSE and GE Courses are six credit courses; the SEC, AEC are four credit courses.

RANI CHANNAMMA UNIVERSITY

Vidyasangama, P-B, NH-4, Belagavi. -591156

Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Chemistry Major& One Minor Discipline Scheme for the Four Years Chemistry B.Sc. Undergraduate Honors Programme with effect from 2021-22

SEMESTER-I										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L1	21BSC1L1LK1	Kannada	40	60	100	4	-	-	3	2
	21BSC1L1LFK1	Functional Kannada								
L2	21BSC1L2LEN2	English	40	60	100	4	-	-	3	2
	21BSC1L2LHI2	Hindi								
	21BSC1L2LSN2	Sanskrit								
	21BSC1L2LTE2	Telugu								
	21BSC1L2LUR2	Urdu								
DSC1	21BSC1C1CHE1L	Chemistry-1	40	60	100	4	-	-	4	2
	21BSC1C1CHE1P	Chemistry Lab-1	25	25	50	-	-	4	2	4
DSC1	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	4
SEC1	21BSC1S1CS1	Digital Fluency	25	25	50	1	-	2	2	2
VBC1	21BSC1V1PE1	Physical Education-Yoga	25	-	25	-	-	2	1	-
VBC2	21BSC1V2HW1	Health & Wellness	25	-	25	-	-	2	1	-
OEC1	21BSC1O1CHE1	Chemistry in daily life	40	60	100	3	-	-	3	2
		Total Marks			**700**	**Semester Credits**			**25**	
Note: *All skill enhancement course (SEC) syllabus and title should be selected time to time notice from the university and/ or NEP committee accordingly.*										

SEMESTER-II										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L3	21BSC2L3LK2	Kannada	40	60	100	4	-	-	3	2
	21BSC2L3FKL2	Functional Kannada								
L4	21BSC2L4EN2	English	40	60	100	4	-	-	3	2
	21BSC2L4HI2	Hindi								
	21BSC2L4SN2	Sanskrit								
	21BSC2L4TE2	Telugu								
	21BSC2L4UR2	Urdu								
DSC2	21BSC2C2CHE2L	Chemistry-2	40	60	100	4	-	-	4	2
	21BSC2C2CHE2P	Chemistry Lab-2	25	25	50	-	-	4	2	4
DSC2	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	4
AECC 1	21BSC2AE1ES	Environmental Studies	20	30	50	1	-	2	2	2
VBC3	21BSC2V3PE2	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC4	21BSC2V4NC1	NCC/NSS/R&R(S &G) / Cultural	25	-	25	-	-	2	1	-
OEC2	21BSC2O2CHE2	Molecules of life	40	60	100	3	-	-	3	2
Total Marks					**700**	**Semester Credits**			**25**	

Exit option with Certificate (50 credits)

SECOND YEAR; SEMESTER-III										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L5	21BSC3L5LK3	Kannada	40	60	100	4	-	-	3	2
	21BSC3L5LFK3	Functional Kannada								
L6	21BSC3L6EN3	English	40	60	100	4	-	-	3	2
	21BSC3L6HI3	Hindi								
	21BSC3L6SN3	Sanskrit								
	21BSC3L6TE3	Telugu								
	21BSC3L6UR3	Urdu								
DSC3	21BSC3CHE3L	Chemistry-3	40	60	100	4	-	-	4	2
	21BSC3CHE3P	Chemistry Lab-3	25	25	50	-	-	4	2	4
DSC3	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	4
SEC2	21BSC3S2AI	Artificial Intelligence	25	25	50	1	-	2	2	2
VBC5	21BSC3V5PE3	Physical Education- Sports	25	-	50	-	-	2	1	-
VBC6	21BSC3V6NC2	NCC/NSS/R&R (S&G) / Cultural	25	-	50	-	-	2	1	-
OEC3	21BSC3O3CHE3	Atomic structure, bonding and concepts in organic chemistry	40	60	100	3	-	-	3	2
Total Marks					**700**	**Semester Credits**			**25**	

SEMESTER-IV										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L7	21BSC4L7LK4	Kannada	40	60	100	4	-	-	3	2
	21BSC4L7LFK4	Functional Kannada								
L8	21BSC4L8EN4	English	40	60	100	4	-	-	3	2
	21BSC4L8HI4	Hindi								
	21BSC4L8SN4	Sanskrit								
	21BSC4L8TE4	Telugu								
	21BSC4L8UR4	Urdu								
DSC4	21BSC4C4CHE4L	Chemistry-4	40	60	100	4	-	-	4	2
	21BSC4C4CHE4P	Chemistry Lab-4	25	25	50	-	-	4	2	4
DSC4	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	4
AECC 2	21BSC4AE2CI	Constitution of India	20	30	50	1	-	2	2	2
VBC7	21BSC4V5PE4	Physical Education-Sports	25	-	25	-	-	2	1	-
VBC8	21BSC4V6NC3	NCC/NSS/ R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC4	21BSC4O4CHE4	Electrochemistry, corrosion and Metallurgy	40	60	100	3	-	-	3	2
			Total Marks		**700**	**Semester Credits**			**25**	

Exit option with Diploma (100 credits)

SEMESTER-V										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
Chemistry **as Major Discipline**										
DSC5	21BSC5C5CHE5L	Chemistry-5	40	60	100	3	-	-	3	2
	21BSC5C5CHE5P	Chemistry Lab-5	25	25	50	-	-	4	2	4
DSC6	21BSC5C5CHE6L	Chemistry-6	40	60	100	3	-	-	3	2
	21BSC5C5CHE6P	Chemistry Lab-6	25	25	50	-	-	4	2	4
DSC5	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	2
			25	25	50	-	-	4	2	4
VC1	21BSC5VC1	Vocational-I	40	60	100	3	-	-	3	2
VBC9	21BSC5V5PE5	Physical Education-Sports	25	-	25	-	-	2	1	-
VBC10	21BSC5V6NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC3	21BSC5S3CS	Cyber security	25	25	50	1	-	2	2	2
Total Marks					**650**	**Semester Credits**			**22**	

SEMESTER-VI										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
Chemistry **as Major Discipline**										
DSC7	21BSC6C6CHE7L	Chemistry-7	40	60	100	3	-	-	3	2
	21BSC6C6CHE7P	Chemistry Lab-7	25	25	50	-	-	4	2	4
DSC8	21BSC6C6CHE8L	Chemistry-8	40	60	100	3	-	-	3	2
	21BSC6C6CHE8P	Chemistry Lab-8	25	25	50	-	-	4	2	4
DSC6	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	2
			25	25	50	-	-	4	2	4
VC2	21BSC6VC2	Vocational-II	40	60	100	3	-	-	3	2
INT1	21BSC6 INT1L	Internship	25	50	75	-	-	2	2	2
VBC1	21BSC6V5PE5	Physical Education-Sports	25	-	25	-	-	2	1	-
VBC2	21BSC6V6NC4	NCC/NSS/R&R (S&G) / Cultural	25	-	25	-	-	2	1	-
SEC4	21BSC6S4PC	Professional communication	25	25	50	1	-	2	2	2
Total Marks					**700**	**Semester Credits**			**24**	
Total Marks for BSC Program					**-**	**Total Credits for BSC Program**			**146**	

*Internship between 5th and 6th semester with 3-4 weeks

Chemistry Subject as a Minor Discipline

SEMESTER-V										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC5 As a Minor Subject	21BSC5C5CHE5L	Chemistry -5	40	60	100	3	-	-	3	2
	21BSC5C5CHE5P	Chemistry lab-5	25	25	50	-	-	4	2	4

SEMESTER-VI										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC7 As a Minor Subject	21BSC6C6CHE7L	Chemistry -7	40	60	100	3	-	-	3	2
	21BSC6C6CHE7P	Chemistry Lab-7	25	25	50	-	-	4	2	4

Exit option with Bachelor of Science, B. Sc. Basic Degree (146 credits)

SEMESTER-VII										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
Chemistry **(General) as Major Discipline**										
DSC9	21BSC7C9CHE9L	Chemistry-9	40	60	100	4	-	-	4	2
	21BSC7C9CHE9P	Chemistry Lab-9	25	25	50	-	-	4	2	4
DSC10	21BSC7C10CHE10L	Chemistry-10	40	60	100	4	-	-	4	2
	21BSC7C10CHE10P	Chemistry Lab-10	25	25	50	-	-	4	2	4
DSC11	21BSC7C11CHE11L	Chemistry-11	40	60	100	4	-	-	4	2
	21BSC7C11CHE11P	Chemistry Lab-11	25	-	25	-	-	4	2	4
DSE1	21BSC7E1CHE1L	Spectroscopy-1	40	60	100	4	-	-	4	4
DSE2	21BSC7E2CHE2L	Research Methodology	40	60	100	3	-	-	3	4
Total Marks					**650**	**Semester Credits**			**25**	

SEMESTER-VIII										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
Chemistry **(General) as Major Discipline**										
DSC12	21BSC8C12CHE12L	Chemistry-9	40	60	100	4	-	-	4	2
	21BSC8C12CHE12P	Chemistry Lab-9	25	25	50	-	-	4	2	2
DSC13	21BSC8C13CHE13L	Chemistry-10	40	60	100	4	-	-	4	2
	21BSC7C13CHE13P	Chemistry Lab-10	25	25	50	-	-	4	2	2
DSC14	21BSC7C14CHE14L	Chemistry-11	40	60	100	4	-	-	4	2
	21BSC7C14CHE14P	Chemistry Lab-11	25	25	50	-	-	4	2	2
DSE3	21BSC8E3CHE3L	Spectroscopy-II	40	60	100	4	-	-	4	2
DSE4	21BSC8E4CHE4L	Research Project	50	100	150	-	-	8	4	2
Total Marks					**700**	**Semester Credits**			**26**	

Award of Bachelor of Science (Hons) degree in a Chemistry (197 credits)

Concept Note, Abbreviation Explanation and Coding:

Concept Note:

1. **CBCS** is a mode of learning in higher education which facilitates a student to have some freedom in selecting his/her own choices, across various disciplines for completing a UG/PG program.
2. A credit is a unit of study of a fixed duration. For the purpose of computation of workload as per UGC norms the following is mechanism be adopted in the University:
   One credit (01) = One Theory Lecture (L) period of one (1) hour.
   One credit (01) = One Tutorial (T) period of one (1) hour.
   One credit (01) = One practical (P) period of two (2) hours.
3. Course: paper/subject associated with AECC, DSC, DSEC, SEC, VBC, OEC, VC, IC and MIL
4. In case of **B.Sc**. **Once a candidate chose two courses/subjects of a particular two department in the beginning, he/she shall continue the same till the end of the degree/Hons, then there is no provision to change the course(s) and Department(s) in between.**
5. A candidate shall choose **one of the Department's courses as major and other Department course as minor in fifth and sixth semester and major course will get continued in higher semester.**
6. Wherever there is a practical there will be no tutorial and vice-versa
7. A major subject is the subject that's the main focus of Core degree/concerned.
8. A minor is a secondary choice of subject that complements core major/ concerned.
9. Vocational course is a course that enables individual to acquire skills set that are required for a particular job.
10. Internship is a designated activity that carries some credits involving more than **25 days** of working in an organization (either in same organization or outside) under the guidance of an identified mentor. Internship shall be an integral part of the curriculum.
11. **OEC: For non- chemistry students. Chemistry students have to opt for OEC from departments other than major and minor disciplines.**

Abbreviation Explanations:

1. AECC: Ability Enhancement Compulsory Course.
2. DSC: Discipline Specific Core Course.
3. DSEC: Discipline Specific Elective Course.
4. SEC: Skill Enhancement Course.
5. VBC: Value Based Course.
6. OEC: Open/Generic Elective Course
7. VC: Vocational Course.
8. IC: Internship Course
9. L1: Language One
10. L2: MIL
11. L= Lecture; T= Tutorial; P=Practical.
12. MIL= Modern Indian Language; English or Hindi or Telugu or Sanskrit or Urdu

Program Coding:

1. Code 21: Year of Implementation
2. Code BSC: BSC Program under the faculty of Applied Science of the University
3. Code 1: First Semester of the Program, (2 to 6 represent higher semesters)
4. Code AE: AECC, (C for DSC, S for SEC, V for VBC and O for OEC)
5. Code 1: First "AECC" Course in semester, similarly in remaining semester for such other courses
6. Code LK: Language Kannada, similarly Language English, Language Hindi, Language Telugu, Language Sanskrit, &Language Urdu
7. Code 1: Course in that semester.
8. CHE: Chemistry

Note: *All skill enhancement course (SEC) syllabus and title should be selected time to time notice from the university and/ or NEP committee accordingly.*

ASSESSMENT METHODS
Evaluation Scheme for Internal Assessment:

Theory:

Assessment Criteria	40 marks
1st Internal Assessment Test for30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks. Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25 marks
1st Internal Assessment Test for 20 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 20 marks 1 hr after 15 weeks. Average of two tests should be considered.	20
Assignment	05
Total	**25**

Practical:

Assessment Criteria	25 marks
Semester End Internal Assessment Test for 20 marks 2 hrs	20
Journal (Practical Record)	05
Total	**25**

Question Paper Pattern:

RANI CHANNAMMA UNIVERSITY
Department of Chemistry

Duration: 2hr ***I Semester B.Sc (****Chemistry****)***
Sub: **Code:** **Maximum Marks: 60**

a. Answer any SIX Questions from Question 1

b. Answer any Three in each Question from 2,3,4 and 5 questions.

Q.No.1.	**Answer any SIX Questions (Two question from each Unit)** **a.** **b.** **c.** **d,** **e.** **f.** **g.** **h.**	**2X6=12**
Q.No.2.	**(Should cover entire unit-I)** **a.** **b.** **c.** **d.**	**4X3=12**
Q.No.3.	**(Should cover Entire Unit-II)** **a.** **b.** **c.** **d.**	**4X3=12**
Q.No.4.	**(Should cover Entire Unit-III)** **a.** **b.** **c.** **d.**	**4X3=12**
Q.No.5.	**(Should cover Entire Unit-IV)** **a.** **b.** **c.** **d.**	**4X3=12**

SYLLABUS

BSc (Hons) Chemistry-Semester 1

Title of the Course: DSC-1: Subject code: 21BSC1C1CHE1L Paper: Chemistry – 1

Number of Theory Credits	**Number of lecture hours/ semester**	**Number of practical credits**	**Number of practical hours / semesters**	
4	**56**	**2**	**56**	
Content of Theory Course 1				**56hr**
Unit – 1 Analytical chemistry:				14
Definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques. Choice of an analytical method - accuracy, precision, sensitivity, selectivity, method validation. Figures of merit of analytical methods and limit of detection (LOD), Limit of quantification (LOQ), linear dynamic range (working range). Errors and treatment of analytical data: Limitations of analytical methods – Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finite samples -mean, median, range, standard deviation and variance. External standard calibration - regression equation (least squares method), correlation coefficient (R^2). Numerical problems **Titrimetric analysis:** Basic principle of titrimetric analysis. Classification, Preparation and dilution of reagents/solutions. Normality, Molarity and Mole fraction. Use of N1V1= N2V2 formula, Preparation of ppm level solutions from source materials (salts), conversion factors. **Acid-base titrimetry**: Theory, Titration curves for all type of acid- base titrations. Quantitative applications – selecting and standardizing a titrant, inorganic analysis - alkalinity, acidity. **Complexometric titrimetry**: Indicators for EDTA titrations - theory of metal ion indicators, titration methods employing EDTA - direct, back, displacement and indirect determinations, Application determination of hardness of water. **Redox titrimetry**: Balancing redox equations, calculation of the equilibrium constant of redox reactions, titration curves, Theory of redox indicators, calculation of standard potentials using Nernst equation. Applications. **Precipitation titrimetry**: Titration curves, titrants and standards, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences.				
Unit - 2 ATOMIC STRUCTURE & PERIODICITY OF ELEMENTS **Atomic Structure:** Review of Rutherford's atomic model, Bohr's theory, Hydrogen atomic spectra. Derivation of radius and energy of an electron in hydrogen atom, limitations of Bohr's theory, dual behavior of matter and radiation, de Broglie's equations, Heisenberg Uncertainty principle and their related problems. Quantum mechanics. Derivation of Schrodinger's wave equation for hydrogen atom and				14

meanings of various terms in it. Significance of ψ and ψ^2. Radial and angular wave functions (atomic orbitals) and their distribution curves for 1*s*, 2*s*, 2*p*, 3*s*, 3*p* and 3*d* orbitals (Only graphical representation). Radial and angular nodes and their significance. Quantum numbers and their significance. Orbital s h a p e s of *s, p, d and f* atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, Electronic configurations of the atoms (atomic number up to 54). Concept of exchange energy. Anomalous electronic configurations. IUPAC nomenclature of elements with atomic number greater than hundred. **(10 Lectures)** **Periodicity of elements:** Brief account on the following properties of elements with reference to s and p-block and trends in groups and periods. Effective nuclear charge, screening effect, Slater rules, atomic and ionic radii, ionization enthalpy, electron gain enthalpy, and electronegativity, Pauling / Allred-Rochow scales**.** Numerical problems are to be solved wherever applicable. **(04 Lectures)**	
Unit - 3 Bonding in Organic Molecules and Mechanism of Organic reactions	14
Classification and nomenclature of organic compounds, Hybridization, Shapes of organic molecules m Influence of hybridization on bond properties. **Nature of bonding in Organic molecules** Formation of Covalent bond, Types of chemical bonding, localized and delocalized, conjugation and cross conjugation, concept of resonance, electronic displacements: Inductive effect, Electromeric effect, Resonance and Hyper conjugation, cross conjugation explanation with examples. Concept of resonance, aromaticity, Huckel rule, anti-aromaticity explanation with examples. **(04 Lectures)**	
Mechanisms of Organic Reactions Notations used to represent electron movements and directions of reactions- curly arrows, formal charges. Types of bonds breaking- homolytic and heterolytic. Types of reagents-Electrophiles, nucleophiles, nucleophilicity and basicity. Types of organic reactions- substitution, addition, elimination, rearrangement and pericyclic reactions, explanation with examples. **Chemistry of Aliphatic hydrocarbons: Carbon-Carbon Sigma bonds** Chemistry of alkanes: Formation of alkanes, Wurtz reaction, Wurtz-Fittig reaction, Free radical substitutions Mechanism of Halogenation- relative reactivity and selectivity **Carbon-carbon pi bonds:** Formation of alkenes and alkynes by elimination reaction. Mechanism of E1, E2, E1cb reaction. Saytzeff and Hofmann eliminations. Addition of HBr to propene, Free radical addition of HBr to propene. Addition of halogens to alkenes-carbocation and halonium ion mechanism. Stereo-specificity of halogen addition. Ozonolysis mechanism - ozonolysis of propene. Diel –Alder reaction and Mechanism of Allylic and benzylic bromination and mechanism in propene,1-butene,1-toluene and ethylbenzebe **(05 Lectures)** **Nucleophilic substitution at saturated carbon.** Mechanism of S_N^1 and S_N^2reactions with suitable examples. Energy profile diagrams, Stereochemistry and factors effecting S_N^1 and S_N^2reactions. **Aromatic Electrophilic substitution reactions**, Mechanisms, σ and π complexes, Halogenation, Nitration, Sulphonation, Friedel Crafts alkylation and acylation with their mechanism. Activating and deactivating groups. Orientation influence, Ortho-para ratio. Aromatic nucleophilic substitution reaction: S_N^{Ar} and Benzyne mechanism with suitable examples. **(05 Lectures)**	

Unit - 4 GASES & LIQUIDS **Gaseous state:** Review of kinetic theory of gases, van der Waals equation of state Boyle temperature. Molecular velocity: Maxwell's Boltzmann distribution law of molecular velocities (most probable, average and root mean square velocities). Relation between RMS, average and most probable velocity and average kinetic energies (derivation not required), law of equipartition of energy. Collision frequency, collision diameter, Collision cross-section, collision number and mean free path and coefficient of viscosity, calculation of σ and η , variation of viscosity with temperature and pressure. Critical phenomena: Andrews isotherms of CO_2, critical constants and their determination Relation between critical constants and van der Waals equation (Derivation), continuity of states, law of corresponding states. Numerical problems are to be solved wherever applicable. **(7 Lectures)** **Solids** **Forms of solids:** Unit cell and space lattice, anisotropy of crystals, size and shape of crystals, Laws of Crystallography: Law of constancy of interfacial angles, Law of rational indices, Law of symmetry (Symmetry elements), Crystal systems, Bravais lattice types and identification of lattice planes. Miller indices and its calculation, X–Ray diffraction by crystals: Bragg's law and derivation of Bragg's equation, Single crystal and powder diffraction methods. Defects in crystals, glasses and liquid crystals. Numerical problems. **Distribution Law** Nernst Distribution Law - Statement and its derivation. Distribution constant, factors affecting distribution constant, validity of Distribution Law, Modification of distribution law when molecules undergo a) Association b) Dissociation. Application of Distribution Law in Solvent extraction. Derivation for simple and multiple extraction. Principles of distribution law in Parkes Process of desilverisation of lead. Numerical Problems. **(7 Lectures)**	14

LEARNING OUTCOMES / COURSE OUTCOMES:

Chemistry as Discipline Specific Course (DSC)

B.Sc. Semester – I; CHEMISTRY-1

After successful completion of three year degree program in Chemistry a student should be able to;

1. Describe the dual nature of radiation and matter; dual behaviour of matter and radiation, de Broglie's equations, Heisenberg Uncertainty principle and their related problems.
2. Quantum mechanics. Derivation of Schrodinger's wave equation. Orbital shapes of *s, p, d and f* atomic orbitals, nodal planes. Electronic configurations of the atoms.
3. Define periodicity, explain the cause of periodicity in properties, and classify the elements into four categories according to their electronic configuration.
4. Define atomic radii, ionisation energy, electron affinity and electronegativity, discuss the factors affecting atomic radii, describe the relationship of atomic radii with ionisation energy and electron affinity, describe the periodicity in atomic radii, ionization energy, electron affinity and electronegativity.
5. Explain bond properties, electron displacement effects (inductive effect, electrometric effect, resonance effect and Hyper conjugation effect). Steric effect and their applications in explaining acidic strength of carboxylic acids, basicity of amines.
6. Understand basic concept of organic reaction mechanism, types of organic reactions, structure, stability and reactivity of reactive intermediates.
7. Describe important characteristics of configurationally and conformational isomers. Practice and write conformational isomers of ethane, butane and cyclohexane.
8. Understand the various concepts of geometrical isomerism and optical isomerism. Describe CIP rules to assign E,Z notations and R& S notations. Explain D and L configuration and *threo* and *erythro* nomenclature.
9. Explain racemic mixture and racemisation, resolution of racemic mixture through mechanical separation, formation of diastereomers, and biochemical methods, biological significance of chirality.
10. Explain the existence of different states of matter in terms of balance between intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabatic expansion.
11. Describe the conditions required for liquefaction of gases. Realise that there is continuity in gaseous and liquid state.
12. Explain properties of liquids in terms of intermolecular attractions.
13. Understand principles of titrimetric analysis.
14. Understand principles of different type's titrations. Titration curves for all types of acids – base titrations.
15. Gain knowledge about balancing redox equations, titration curves, theory of redox indicators and applications.
16. Understand titration curves, indicators for precipitation titrations involving silver nitrate-Volhard's and Mohr's methods and their differences.
17. Indicators for EDTA titrations - theory of metal ion indicators. Determination of hardness of water.

CHEMISTRY LAB (Inorganic and Organic Analyses)

After studying this course and performing the experiments set in it student will be able to:

1. Understand and practice the calibration of glasswares (burette, pipette, volumetric flask).
2. Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standard solutions.
3. Explain the principles of acid-base, redox and iodometric titrations.
4. Work out the stoichiometric relations based on the reactions involved in the titrimetric analysis.
5. Based on principles of titrimetric analysis student can perform
6. Describe the significance of organic quantitative analysiss.
7. Determine the amount of phenol, aniline, amide, ester and formaldehyde in a given solution by performing blank titration and main titrations.
8. Determine aspirin in the tablet by hydrolysis method.

References

1. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D.Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, Pearson Education Pvt.Ltd.(2007).
2. Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8th edition, Saunders College Publishing, New York (2005).
3. Analytical Chemistry, G.D. Christian, 6th edition, Wiley-India (2007).
4. Practical Volumetric Analysis, Peter A C McPherson, Royal Society of Chemistry, Cambridge, UK (2015).
5. Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)
6. Finar, I. L. *Organic Chemistry (Volume I),* Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)
7. McMurry, J. E. *Fundamentals of Organic Chemistry,* 7th Ed. Cengage Learning India Edition, 2013
8. Organic Reaction mechanism by V. K. AhIuwalia and K. Parashar (Narosa Publishers).
9. Organic Chemistry by S. M. Mukherji, S. P. Singh and R. K. Kapoor. (Narosa Publishers)
10. A Guide book to mechanism in Organic Chemistry by Peter sykes. Pearson.

Chemistry Lab-1: List of experiments to be conducted
Course code: 21BSC1C1CHE1P; Paper: Chemistry Lab-1

PART-A Analytical Chemistry

1. Calibration of glassware, pipette, burette and volumetric flask.
2. Determination of sodium carbonate and sodium bicarbonate in a mixture.
3. Determination of alkali present in soaps/detergents
4. Determination of iron(II) using potassium dichromate
5. Determination of oxalic acid using potassium permanganate solution
6. Standardization of EDTA solution and determination of hardness of water
7. Determination of phenol by bromination method
8. Determination of aniline by bromination method.
9. Determination of acetamide by hydrolysis method.
10. Determination of ethyl benzoate by hydrolysis method.
11. Determination of aspirin in the tablet by hydrolysis method.

PART-B Organic Chemistry

1. Selection of suitable solvents for Purification/Crystallization of organic compounds.
2. Preparation of acetanilide from aniline using Zn/acetic acid (Green method).
3. Synthesis of p-nitro acetanilide from acetanilide using nitrating mixture.
4. Bromination of acetanilide (i) Conventional method and /or
   (ii) with ceric ammonium nitrate and potassium bromide (Green method).
5. Hydrolysis of methyl m-nitrobenzoate to m-nitrobenzoic acid (Conventional method)
6. Synthesis of diazoaminobenzene from aniline (conventional method).
7. Preparation of dibenzalacetone (Green method).
8. Diels Alder reaction between furan and maleic acid (Green method).

- Standard solution is to be prepared by students for both in regular and in practical examination.

Examination

In the practical examination, in a batch at least 15 (Fifteen) students may be made. At least two experiments one from inorganic and one from organic experiments is given. Selection of experiments may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus**.** *Manual is not allowed in the examination.*

Deduction of marks for accuracy: : ±0.2 CC -15 marks, ± 0.4 CC- 12 marks, ±0.6 CC- 09 marks, ±0.8 CC- 06 marks, ±0.9 CC- 03 marks, above ±0.9 – zero marks.

Deduction of marks for accuracy: : ±0.2 CC -15 marks, ± 0.4 CC- 12 marks, ±0.6 CC- 09 marks, ±0.8 CC- 06 marks, ±0.9 CC- 03 marks, above ±0.9 – zero marks.

Final semester examination: one experiment from PART-A and PART-B given as a major and minor with 20 +15 marks allotment and subdivision made accordingly by the examiners.

BSc Semester 1 – B.Sc (Hons) Chemistry

Title of the Course: Open Elective (OE-1): CHEMISTRY IN DAILY LIFE

Course code: 21BSC1O1CHE1

Courses	Credits	No. of Classes/Week	Total No. of Lectures/ Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
Theory	03	03	42	2	40	60	100

Content of Theory Course 1	**42 Hrs**
Unit – 1	14
Dairy Products: Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, determination of methyl alcohol in alcoholic beverages. **Food additives, adulterants, and contaminants**- Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. Flavors: Vanillin, alkyl esters (fruit flavors), and monosodium glutamate. **Artificial food colorants:** Coal tar dyes and non-permitted colors and metallic salts. Analysis of pesticide residues in food.	
Unit - 2	14
Vitamins: Classification and Nomenclature. Sources, deficiency diseases, and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1. **Oils and fats**: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils. Halphen test. **Soaps & Detergents**: Definition, classification, manufacturing of soaps and detergents, composition and uses	
Unit - 3	14
Chemical and Renewable Energy Sources: Principles and applications of primary & secondary batteries and fuel cells. Basics of solar energy, future energy storer. **Polymers:** Basic concept of polymers, classification and characteristics of polymers. Applications of polymers as plastics in electronic, automobile components, medical fields, and aerospace materials. Problems of plastic waste management. Strategies for the development of environment-friendly polymers.	

COURSE OUTCOMES: OEC-1 Chemistry

On completion of the course students will be able to:

- Understand the chemical constituents in various day to day materials using by a common man.
- Understand the chemical constituents in fertilizers, insecticides and pesticides, chemical explosives etc.
- Understand the chemical constituents in polymers, surface coatings etc.

References Text Books

1. B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry- Ashtoush Kar.
3. Analysis of Foods – H.E. Cox: 13.
4. Chemical Analysis of Foods – H.E. Cox and Pearson.
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4thed. New Age International (1998)
6. Physical Chemistry – P l Atkins and J. de Paula – 7thEd. 2002, Oxford University Press.

SKILL ENHANCEMENT COURSE IN CHEMISTRY

Title of the Course: SEC: Course code: 21BSC1E1CS1
Paper name : Digital Fluency

Courses	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
Theory	02	01	11	---	---	10	10
Practical		02	22	2	25	15	40
				Total	25	25	50

BSc Semester 2 – Chemistry (Hons)

Title of the Course: DSC-2: Subject code: 21BSC1C1CHE2L Paper: Chemistry – 2

Number of Theory Credits	**Number of lecture hrs/semester**	**Number of practical Credits**	**Number of practical hrs/ sem**
4	56	**2**	**56**
Content of Theory Course 2			**56Hrs**
Unit – 1 Chemical bonding, molecular structure & Periodicity of elements.			14
Ionic Bonding: General characteristics of ionic compounds. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Landé equation and calculation of lattice energy. Born-Haber cycle and its applications. **Polarizing power and polarizability:** Fajan's rules, ionic character in covalent compounds and percentage of ionic character. **Covalent bonding:** General characteristics of covalent compounds. 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 of NO3 - , CO3 2- and SO4 2- . **Molecular Orbital Theory:** LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules and ions of 1st and 2 nd periods and heteronuclear diatomic molecules such as CO, NO and NO + . Comparison of VB and MO approaches. Numerical problems are to be solved wherever applicable. (**14 Lectures**)			

Unit - 2 Acidic Strengths of Organic compounds and Stereochemistry:	14
Strengths of Organic acid and bases: Comparative study with emphasis on factors effecting pK values. Relative strength of aliphatic and aromatic carboxylic acids- Acetic acid and chloroacetic acid, acetic acid and propionic acid, acetic acid and Benzoic acid. Steric effect- Relative stability of trans and cis-2-butene. Concept of Confirmation analysis with referee to Ethane & n-Butane with staggered & eclipsed confirmations & energy profile diagrams. (**04 Lectures)** **Stereoisomersim**: Definition of stereoisomerism, conformational isomers and configurational isomers (distinction between conformation and configuration). Newman, Sawhorse and Fischer projection formulae and their interconversions. **Geometrical isomerism:** Definition, reason for geometrical isomerism, E and Z notation -CIP rules and examples, determination of configuration of geometric isomers by dipole moment method and anhydride formation method, *syn* and *anti* isomers in compounds containing C=N. **Optical isomerism:** Chirality/asymmetry, enantiomerism, diastereomerism and meso compounds. R and S notations (compounds with two asymmetric centers), D and L configurations and *threo* and *erythro* nomenclature, racemic mixture and racemization, **Resolution:** Definition, Resolution of racemic mixture by: i) Mechanical separation ii) Formation of diastereomers iii) Biochemical methods. Biological significance of chirality. Problems are to be solved wherever applicable. **(10 Lectures)**	
Unit - 3 Solids & Liquid crystals	14
Solids: Types of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X-Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl. Defects in crystals. **Liquid Crystals:** Explanation, classification with examples- Smetic, nematic, cholesteric, disc shaped and polymeric. Structures of nematic and cholesteric phasesmolecular arrangements in nematic and cholesteric liquid crystals. Applications of liquid crystals in LCDs and thermal sensing. Numerical problems are to be solved wherever applicable. (**7 Lectures**) **Chemical Kinetics:** Review of reaction rates, order and molecularity. Factors affecting rates of reaction: concentration pressure, temperature, catalyst, etc. Examples for different orders of reactions. Derivation of integrated rate equations for zero and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction (numerical problems). Methods for determination of order of a reaction by half life period and differential equation method. Effect of temperature on reaction rates,	

temperature coefficient, 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). Numerical problems are to be solved wherever required. (**7 Lectures**)	
Unit - 4 ANALYTICAL CHEMISTRY	14
Liquid state: Molecular forces and general properties of liquids. **Surface tension:** surface tension, surface energy, effect of temperature on surface tension, shapes of liquid drops and soap bubbles, capillary action, determination of surface tension by capillary rise method, drop weight and drop number methods using stalagmometer. Effect of temperature on surface tension. Parachor, Additive and constitutive properties: atomic and structural parachor. Elucidation of structure of benzene and benzoquinone. **Viscosity:** Definition, viscosity coefficient, fluidity, molecular viscosity, relative viscosity and absolute viscosity, determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature, size, weight, shape of molecules and intermolecular forces. **Refractive index:** Definition, Specific and molar refraction. Determination of refractive index using Abbe's refractometer. Additive and constitutive properties: Elucidation of structure of molecules. Numerical problems are to be solved wherever applicable. (**8 Lectures**) **Gravimetric Analysis:** Stages in gravimetric analysis, requisites of precipitation, theories of precipitation, factors influencing precipitation, co-precipitation and postprecipitation. Structure, specificity, conditions and applications of organic reagents such as salcylaldoxime, oxine, dimethyl glyoxime, cupron and cupferron in inorganic analysis. Advantages of organic reagents over inorganic reagents. (**6 Lectures**)	

Reference Books

1. **Inorganic Chemistry**

1. Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J. J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
4. Huheey, J. E., Keiter, E.A., Keiter, R.L. & Medhi, O. K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
5. Shriver, D.F. & Atkins, P.W. *Inorganic Chemistry*, Oxford University Press.
6. Wulfsberg, G. *Inorganic Chemistry*, Viva Books Pvt. Ltd.
7. Rodgers, G. E. *Inorganic & Solid State Chemistry*, Cengage Learning India Ltd.,2008.
8. Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012) Adam, D.M. *Inorganic Solids: An introduction to concepts in solid-state structural chemistry*. John Wiley & Sons, 1974.
9. G.L. Miessler & Donald A. Tarr: *Inorganic Chemistry*, Pearson Publication.
10. Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
11. Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York(1985).

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1. Organic Chemistry-P. Y. Bruice, 7th Edition, Pearson Education Pvt. Ltd., New Delhi (2013).
2. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi,2004
3. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
4. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.
6. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
7. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.
8. Graham Solomons, T. W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
9. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
10. Organic Chemistry-F.A. Carey, 4th Edition, McGraw Hill (2000).
11. Modern Organic Chemistry - R.O.C. Norman and D.J. Waddington, ELBS, 1983
12. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998
13. Organic Chemistry - L. Ferguson, Von Nostrand, 1985
14. Organic Chemistry - M. K. Jain, Nagin & Co., 1987
15. Organic Chemistry- Mehta and Mehta.

Physical Chemistry

1. Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
2. Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
4. P.W. Atkins: Physical Chemistry.
5. W.J. Moore: Physical Chemistry
6. Text Book of Physical Chemistry - P.L. Soni, S. Chand & Co.,1993
7. Text Book of physical chemistry - S. Glasstone, Mackmillan India Ltd., 1982
8. Principles of Physical Chemistry - B. R. Puri, L.R. Sharma and M.S.Patania, S.L.N. Chand & Co. 1987

9. Physical Chemistry - Alberty R. A. and Silbey, R.J.John Wiley and sons, 1992
10. Physical Chemistry - G.M.Barrow, Mc Graw Hill, 1986
11. Physical Chemistry(3rd Edition) - Gilbert W. Castilian, Narosa Publishing House,1985
12. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., New Delhi.
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2. Willard, H. H., Merritt, L.L., Dean, J. & Settle, F.A. *Instrumental Methods of Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
3. Christian, G.D; *Analytical Chemistry*, VI Ed. John Wiley & Sons, New York, 2004.
4. Harris, D. C. *Exploring Chemical Analysis*, Ed. New York, W.H. Freeman, 2001.
5. Skoog, D. A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.

Content of Chemistry Lab-2: List of Experiments to be conducted

Title of the Course: DSC-2: Subject code: 21BSC1C1CHE2P; Paper: Chemistry Lab-2

PART-A Inorganic Chemistry

TITRIMETRY

1. Determination of carbonate and hydroxide present in a mixture.
2. Determination of oxalic acid and sodium oxalate in a given mixture using standard $KMnO_4$/NaOH solution
3. Standardization of potassium permanganate solution and determination of nitrite in a water sample
4. Standardization of silver nitrate and determination of chloride in a water sample (demonstration)
5. Determination of alkali content in antacids
6. Determination of chlorine in bleaching powder using iodometric method.

GRAVIMETRY

1. Determination of Ba^{2+} as BaSO4
2. Determination of Cu^{2+} as CuSCN

PART-B Physical Chemistry

1. Safety Practices in the Chemistry Laboratory, Knowledge about common toxic chemicals and safety measures in their handling, cleaning and drying of glassware's
2. Determination of density using specific gravity bottle and viscosity of liquids using Ostwald's viscometer (Ethyl acetate, Toluene, Chloroform, Chlorobenzene or any other non-hazardous liquids).
3. Study of the variation of viscosity of sucrose solution with the concentration of a solute.
4. Determination of the density using specific gravity bottle and surface tension of liquids using Stalagmometer (Ethyl acetate, Toluene, Chlorobenzene, any other non-hazardous liquids.
5. Study of variation of surface tension of detergent solution with concentration.
6. Determination of specific and molar refraction by Abbes Refractometer. (Ethyl acetate, Methyl acetate, Ethylene Chloride).
7. Determination of the composition of liquid mixture by refractometry. (Toluene & Alcohol, Water & Sucrose).
8. Determination of partition/distribution coefficient - i) Acetic acid in water and cyclohexane.
   ii) Acetic acid in Water and Butanol. iii) Benzoic acid in water and toluene.

** Standard solution is to be prepared by students for both in regular and in practical examination.

Examination

In the practical examination, in a batch at least 15 (Fifteen) students may be made. At least two experiments one from inorganic and one from organic experiments is given. Selection of experiments may be done by the students based on lots. Viva questions may be asked on any of the experiments prescribed in the practical syllabus**.** *Manual is not allowed in the examination.*

Deduction of marks for accuracy: : ±0.2 CC -15 marks, ± 0.4 CC- 12 marks, ±0.6 CC- 09 marks, ±0.8 CC- 06 marks, ±0.9 CC- 03 marks, above ±0.9 – zero marks.

Deduction of marks for accuracy: : ±0.2 CC -15 marks, ± 0.4 CC- 12 marks, ±0.6 CC- 09 marks, ±0.8 CC- 06 marks, ±0.9 CC- 03 marks, above ±0.9 – zero marks.

Final semester examination: one experiment from PART-A and PART-B given as a major and minor with 20 +15 marks allotment and subdivision made accordingly by the examiners.

Open Elective Course-Chemistry

Title of the Course: OEC-2: Subject code: 21BSC1O2CHE2; Paper: Molecules of Life
B.Sc. Semester – II

Courses	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
Theory	03	03	42	2	40	60	100

UNIT I

Carbohydrates

Sugars, non-sugars, reducing and non-reducing sugars. Occurrence and general properties of glucose and fructose. Open chain and Haworth ring structures of glucose and fructose. Epimers, mutarotation and anomers.

Disaccaharides: Occurance of disaacharides (Sucrose, Maltose and Lactose). Glycosidic linkage in disaccharides. Ring structures of sucrose, maltose and lactose.

Polysaccharides: Starch – monomer units, glycosidic linkage, components-difference in their structure (explanation only) and solubility in water. Cellulose and glycogen– monosaccharide, glycosidic linkage, structure (explanation only). Biological importance of carbohydrates. **(8 Lecturers)**

Amino Acids, Peptides and Proteins

α- amino acids , general formula, zwitter ion form of α- amino acid, general formula. Isoelectric point and its importance. Classification of amino acids as essential and non-essential- examples. Configuration of optically active α-amino acids (found in proteins). Peptide bond. Proteins: classification based molecular shape –fibrous and globular, examples. Structure of protein – qualitative idea about primary, secondary, tertiary, and quaternary structures (diagrams not required). Denaturation of protein. **(6 lecturers)**

UNIT II

Enzymes and correlation with drug action

Mechanism of enzyme action, factors affecting enzyme action, Co-enzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity),Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Noncompetitive inhibition including allosteric inhibition). **(7 lecturers)**

Drug action- Receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group, -NH_2 group, double bond and aromatic ring. **(4 lecturers)**

Oils and fats

Biological Importance of oils and fats. Fatty acids (saturated, unsaturated fatty acids, formation of triglycerides and general formula of triglycerides. Chemical nature of oils and fats-saponification, acid hydrolysis, rancidity and its prevention methods, refining of oils, hydrogenation of oils, drying of oils. Iodine value.

Introduction to lipids, classification. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol). **(6 lecturers)**

UNIT III

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. **(6 lecturers)**

Vitamins and Hormones

Classification and biological significance, source and structure of Vitamin A, B1(thiamine), B2(riboflavin), B6(pyridoxine), a-tocopherol, K1 (phylloquinone), C(ascorbic acid). Deficiency diseases of vitamins,

Hormones: definition, classification with examples, functions and deficiency diseases of hormones. **(5 lecturers)**

Course Outcome / Learning Outcome:

After studying this paper the student would be able to

1. Acquire knowledge about different types of sugars and their chemical structures.
2. Identify different types of amino acids and determine the structure of peptides.
3. Explain the actions of enzymes in our body and interpret enzyme inhibition.
4. Predict action of drugs. Depict the biological importance of oils and fats. Importance of lipids in the metabolism Differentiate RNA and DNA and their replication. Explain production of energy in our body.

Reference Books:

1. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. *Organic Chemistry* (*Volume 1*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. *Organic Chemistry* (*Volume 2)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D. L. & Cox, M. M. *Lehninger's Principles of Biochemistry 7th Ed.*,
5. W. H. Freeman. Berg, J.M., Tymoczko, J.L. & Stryer, L. *Biochemistry*, 2002.