HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

B.Sc. CHEMISTRY

(DURATION: 3 YEARS)

CURRICULUM AND SYLLABUS

Under Choice Based Credit System

(In line with NEP 2020)

(Applicable for Students admitted from Academic Year 2026-27)

DEPARTMENT OF CHEMISTRY

SCHOOL OF BASIC AND APPLIED SCIENCES

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCINECE, PADUR

Motto:

To Make Every Man *a* Success *and* No Man *a* Failure

Vision:

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

Mission:

- *To create an ecosystem that promotes learning and world class research.*
- *To nurture creativity and innovation.*
- *To instil highest ethical standards and values.*
- *To pursue activities for the development of the Society.*
- *To develop national and international collaborations with institutes and industries of eminence.*
- *To enable graduates to become future leaders and innovators.*

Value Statement:

Integrity, Innovation, Internationalization.

DEPARTMENT OF CHEMISTRY

Vision:

- *The Department of Chemistry strives for the construction of a strong society through Science Education by being adaptive, innovative and constantly meeting the ever-growing demands of the scientific community in inter-disciplinary Chemical Sciences, thus creating prepared minds to face the challenges.*

Mission:

- *To educate the students to gain an understanding of the fundamentals of Chemical sciences through a gradual exposure and equip them with practical skills to face the challenges in Technology Development*

PROGRAMME'S EDUCATIONAL OBJECTIVES (PEO'S):

PEO1. *Excel in his/her professional career and/or pursue higher education including research by applying the knowledge of chemistry.*

PEO2. *Apply chemical principles and theories and acquire skills in synthesis, instrumentation and characterization.*

PEO3. *Work productively as chemistry professional by adopting to environment with lifelong learning and adhering to ethical standards and apply the knowledge acquired for the improvement of the society.*

PROGRAMME OUTCOMES (PO'S):

PO1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study.

PO2: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.

PO3: Critical thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO4: Analytical reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PO5: Research-related skills: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.

PO6: Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

PO7: Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.

PO8: Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO9: Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.

PO10: Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO11: Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.

PO12: Lifelong learning: Ability to acquire knowledge and skills, including "learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

PROGRAMME SPECIFIC OUTCOMES (PSO'S):

PSO 1: Fundamental Knowledge & Laboratory Skills

Graduates will acquire strong foundational knowledge in organic, inorganic, physical, and analytical chemistry and develop hands-on skills to perform chemical experiments safely and accurately.

PSO 2: Analytical Thinking & Problem-Solving

Graduates will be able to analyse chemical data, interpret spectra, apply mathematical tools, and solve chemical problems using logical and scientific reasoning.

PSO 3: Application of Chemistry in Real-World Contexts

Graduates will apply chemical principles to fields such as pharmaceuticals, materials science, environmental studies, and industrial chemistry, and will be prepared for higher studies or entry-level industry roles.

B.Sc. CHEMISTRY										
(CREDIT STRUCTURE 126)										
SEMESTER – I										
SL. NO	COURSE CATEGORY	COURSE CODE	COURSE TYPE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	BCT01001	TH	Atomic Structure and Chemical Bonding	3	1	0	4	0	4
2	PC	BCT01400	PR	Quantitative Inorganic Estimation	0	0	4	2	0	4
3	PC	BCT01002	TH	Role of Chemistry in Daily Life	2	1	0	3	0	3
4	PC	BMA01019	TH	Calculus and Algebra	2	1	0	3	0	3
5	HS	GLS51001	TP	Communication Skills	2	0	1	2	1	3
6	HS	GLS11001	TP	Tamil Art and Culture	1	0	1	1	2	2
7	VA	GGE51003	TH	Environmental Science and Sustainable Development	2	0	0	2	2	2
8	VA	GGE51401/ GGE51402	PR	Out-reach (NCC / NSS) – Level-I	0	0	2	1	2	2
Total					**12**	**3**	**8**	**18**	**7**	**23**

SEMESTER – II										
SL. NO	COURSE CATEGORY	COURSE CODE	COURSE TYPE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	BCT01003	TH	Fundamentals of Organic Chemistry	3	1	0	4	0	4
2	PC	BCT01401	PR	Qualitative Organic Analysis	0	0	4	2	0	4
3	PC	BCT01004	TH	Biochemistry	2	1	0	3	0	3
4	PC	BMA01020	TH	Differential Equations and Statistics	2	1	0	3	0	3
5	AE	BCT01005	TH	Artificial Intelligence in Chemistry	2	1	0	3	0	3
6	HS	GLS51002	TP	Personality Development and Soft Skills	2	0	1	2	1	3
7	HS	GLS51008 GLS51009 GLS51010 GLS11002	TH	Tamil/Hindi/Telugu/Advanced Tamil	2	0	0	2	2	2
8	VA	GGE51431/ GGE51432	PR	Out-reach (NCC / NSS) – Level-II	0	0	2	1		2
				Total	**13**	**4**	**7**	**20**	**3**	**24**

SEMESTER – III										
SL. NO	COURSE CATEGORY	COURSE CODE	COURSE TYPE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	BCT01006	TH	Elements and Functional Group Chemistry	3	1	0	4	0	4
2	PC	BCT01402	PR	Qualitative Inorganic Analysis	0	0	4	2	0	4
3	PC	BPH01002	TP	Mechanics and Thermal Physics	2	1	2	4	0	5
4	DE	BCT015**	TH	Department Elective-1	2	1	0	3	1	3
5	NE	********	TP	Non-department Elective	2	0	2	3	2	4
6	HS	GLS51005	PR	Public Speaking	0	0	2	1	0	2
7	HS	GLS51011 GLS51012 GLS51013 GLS51014 GLS51015 GLS51016	TH	French/German/Spanish/Korean/Mandarin/ Japanese	2	0	0	2	2	2
Total					**11**	**3**	**10**	**19**	**5**	**24**

SEMESTER – IV										
SL. NO	COURSE CATEGORY	COURSE CODE	COURSE TYPE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	BCT01007	TH	Principles of Physical Chemistry	3	1	0	4	0	4
2	PC	BCT01008	TH	Stereochemistry and Heterocyclic Chemistry	3	1	0	4	0	4
3	PC	BCT01403	PR	Preparation of Organic and Inorganic Compounds	0	0	4	2	0	4
4	PC	BCT01009	TH	Instrumental Methods of Chemical Analysis	2	1	0	3	0	3
5	PC	BPH01003	TP	Fundamentals of Applied Physics	2	1	2	4	0	5
6	DE	BCT015**	TH	Department Elective-2	2	1	0	3	1	3
7	HS	GLS51006	PR	English for Competitive Examinations	0	0	2	1	1	2
8	HS	GLS11003 GLS11004 GLS11005 GLS11006 GLS11007 GLS11008	TH	French Intermediate/ German Intermediate/Spanish Intermediate/Korean Intermediate/Mandarin Intermediate/Japanese Intermediate	2	0	0	2	2	2
Total					**14**	**5**	**8**	**23**	**4**	**27**

Note: Students will undergo 1 month of Internship during the IV semester summer vacation and it will be evaluated in the V semester.

SEMESTER – V										
SL. NO	COURSE CATEGORY	COURSE CODE	COURSE TYPE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	BCT01010	TH	Inorganic Polymers and Metal Complexes	3	1	0	4	0	4
2	PC	BCT01011	TH	Chemical Thermodynamics and Kinetics	3	1	0	4	0	4
3	PC	BCT01012	TH	Natural Products and Organic Reactions	3	1	0	4	0	4
4	PC	BCT01404	PR	Physical Chemistry Practical	0	0	4	2	0	4
5	DE	BCT015**	TH	Department Elective-3	2	1	0	3	1	3
6	SE	BCT01013	TH	Quality Control and Quality Assurance	2	0	0	2	1	2
7	SI	BCT01800	IN	Summer Internship	*	*	*	4	*	*
8	HS	GLS51007	TH	Verbal Reasoning and Interview Skills	0	0	2	1	0	2
9	NC	AGE31001	TH	Methodology for Writing a Professional & Scientific Article	1	0	0	0	2	1
Total					**14**	**4**	**6**	**24**	**4**	**24**
* Internship to be undergone during IV semester summer vacation and assessment in V semester.										

SEMESTER – VI										
SL. NO	COURSE CATEGORY	COURSE CODE	COURSE TYPE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	BCT01014	TH	Bioinorganic and Industrial Inorganic Chemistry	3	1	0	4	0	4
2	PC	BCT01015	TH	Phase Rule and Electrochemical Systems	3	1	0	4	0	4
3	PC	BCT01016	TH	Industrial Safety and Hazard Management	2	0	0	2	1	2
4	DE	BCT015**	TH	Department Elective-4	2	1	0	3	1	3
5	HS	GGE51001	TH	Universal Human Values	2	0	0	2	2	2
6	RP	BCT01801	PJ	Research Project	0	0	14	7	0	14
Total					**12**	**3**	**14**	**22**	**4**	**29**

TOTAL CREDITS = 18 + 20 + 19 + 23 + 24 + 22 = **126**

LIST OF DEPARTMENTAL ELECTIVES

SL. NO	COURSE CATEGORY	COURSE TYPE	SEM	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1.	DE 1	TH	III	BCT01500	Pharmaceutical Chemistry	2	1	0	3	1	3
2.		TH	III	BCT01501	Material Science	2	1	0	3	1	3
3.		TH	III	BCT01502	Analytical Chemistry	2	1	0	3	1	3
4.	DE 2	TH	IV	BCT01503	Polymer Chemistry	2	1	0	3	1	3
5.		TH	IV	BCT01504	Surface and Colloidal Chemistry	2	1	0	3	1	3
6.		TH	IV	BCT01505	Quantum Mechanics	2	1	0	3	1	3
7.	DE 3	TH	V	BCT01506	Green Chemistry	2	1	0	3	1	3
8.		TH	V	BCT01507	Nano Chemistry	2	1	0	3	1	3
9.		TH	V	BCT01508	Organometallic Chemistry	2	1	0	3	1	3
10.	DE 4	TH	VI	BCT01509	Industrial Chemistry	2	1	0	3	1	3
11.		TH	VI	BCT01510	Electrochemistry	2	1	0	3	1	3
12.		TH	VI	BCT01511	Nuclear Chemistry	2	1	0	3	1	3

<table>
<tr><td>COURSE TITLE</td><td colspan="3">ATOMIC STRUCTURE AND CHEMICAL BONDING</td><td>CREDITS</td><td>4</td></tr>
<tr><td>COURSE CODE</td><td>BCT01001</td><td>COURSE CATEGORY</td><td>PC</td><td>L-T-P-S</td><td>3-1-0-0</td></tr>
<tr><td>Version</td><td>0.0</td><td>Approval Details</td><td></td><td>LEARNING LEVEL</td><td>BTL-3</td></tr>
<tr><td colspan="6">ASSESSMENT SCHEME</td></tr>
<tr><td colspan="5">CIA</td><td rowspan="2">ESE</td></tr>
<tr><td>First Periodical Assessment</td><td>Second Periodical Assessment</td><td>Seminar/Assignments/Project</td><td>Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC””</td><td>Attendance*</td></tr>
<tr><td>15%</td><td>15%</td><td>10%</td><td>5%</td><td>5%</td><td>50%</td></tr>
<tr><td>Course Description</td><td colspan="5">This course provides foundational knowledge of atomic structure, chemical bonding, stoichiometry, and states of matter. It equips students with essential principles and problem-solving skills needed for advanced studies in chemistry.</td></tr>
<tr><td>Course Objective</td><td colspan="5">The course aims at giving an overall view of the
1. various atomic models and atomic structure
2. wave particle duality of matter
3. periodic table, periodicity in properties and its application in explaining the chemical behaviour
4. nature of chemical bonding, and
5. Chemistry of acids, bases and ionic equilibrium</td></tr>
<tr><td>Course Outcome</td><td colspan="5">Upon completion of this course, the students will be able to
1. explain the atomic structure, wave particle duality of matter, periodic properties bonding,and properties of compounds.
2. classify the elements in the periodic table, types of bonds, reaction intermediates electroniceffects in organic compounds, types of reagents.
3. apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx, Δp electronegativity, percentage ionic character and bond order.
4. evaluate the relationship existing between electronic configuration, bonding, geometry ofmolecules and reactions; structure reactivity and electronic effects.
5. explain the concept of acids, bases and ionic equilibria; periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons.</td></tr>
<tr><td colspan="6">Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.</td></tr>
</table>

CO, PO AND PSO MAPPING															
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
1: Weakly related, 2: Moderately related and 3: Strongly related															

MODULE 1: ATOMIC STRUCTURE AND PERIODIC TRENDS	**(9L+3T)**
History of atom (J.J. Thomson, Rutherford); Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom; The Franck-Hertz Experiment; Interpretation of H- spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De- Broglie wavelength-Davisson and Germer experiment Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund's rule, Pauli 'exclusion principle and Aufbau principle; Numerical problems involving the core concepts**.**	**CO-1** **BTL-3**
MODULE 2: INTRODUCTION TO QUANTUM MECHANICS	**(9L+3T)**
Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wavefunctions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of Ψ and Ψ^2. Modern Periodic Table - Cause of periodicity; Features of the periodic table; classification of elements - Periodic trends for atomic size- atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales, applications of electronegativity. Problems involving the core concepts	**CO-2** **BTL-3**
MODULE 3: STRUCTURE AND BONDING - I	**(9L+3T)**
Ionic bond - Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarization – polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds; problems involving the core concepts. **Covalent bond -** Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency - hybridization; VSEPR theory - shapes of molecules of the type AB_2, AB_3, AB_4, AB_5, AB_6 and AB_7. Partial ionic character of covalent bond-dipole moment, application to molecules of the type A_2, AB, AB_2, AB_3, AB_4; percentage ionic character- numerical problems based on calculation of percentage ionic character.	**CO-3** **BTL-3**
MODULE 4: STRUCTURE AND BONDING - II	**(9L+3T)**

VB theory–application to hydrogen molecule; concept of resonance- resonance Structures of some inorganic species–CO_2, NO_2, CO_3^{2-}, NO_3^- limitations of VBT; MO theory - bonding, antibonding and nonbonding H_2, C_2, O_2, O_2^+, O_2^-, O^{2-}, N_2, NO, HF, CO, CO_2. Magnetic characteristics, comparison of VB and MO theories. Coordinate bond: Definition, Formation of BF3,NH3,NH4+,H3O+properties Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors. Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding–Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boiling points	**CO-4** **BTL-3**
MODULE 5: ACIDS, BASES AND IONIC EQUILIBRIA	**(9L+3T)**
Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of poly basic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves - use of acid base indicators. Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation. Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases - hydrolysis constant, degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis. Solubility product-determination and applications; numerical problems Involving the core concepts**.**	**CO-5** BTL-3

BOOKS	
1.	Dash UN, Dharmarha OP, Soni P.L. " Textbook of Physical Chemistry", Sultan Chand & Sons: New Delhi, 2016
2.	Gurudeep Raj, "Advanced Inorganic Chemistry Vol – I", Goel Publishing House, Meerut, 26th Edi., 2001.
REFERENCE BOOKS	
1	Atkins, P.W. & Paula, J. "Physical Chemistry", Oxford University Press: New York, 10th Ed., 2014.
2	Lee, J. D. "Concise Inorganic Chemistry", ELBS WilliamHeinemann: London, 4th ed., 1991.
3	Huheey, J. E. "Inorganic Chemistry: Principles of Structure and Reactivity", Addison, Wesley Publishing Company: India, 4th ed., 1993.
4	
E Resources for Reference	
1.	https://onlinecourses.nptel.ac.in
2.	http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm
3.	https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding
MOOC	
1.	nptel.ac.in/courses/104106096
2.	Chemistry: Atomic Structure and Chemical Bonding - Course

COURSE TITLE	QUANTITATIVE INORGANIC ESTIMATION			CREDITS	2
COURSE CODE	BCT01400	COURSE CATEGORY	PC	L-T-P-S	0-0-4-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

CIA					ESE
Experimental	Calculation	Result	Viva	Record	
20%	10%	10%	5%	5%	50%

Course Description	**Quantitative Inorganic Estimation introduces classical volumetric and gravimetric techniques for accurate determination of inorganic ions. The course emphasizes analytical precision, standardization, and laboratory skills essential for chemical analysis.**
Course Objective	The course aims at giving an overall view of the 1. laboratory safety 2. handling glassware 3. Quantitative estimation 4. preparation of inorganic compounds
Course Outcome	Upon completion of this course, the students will be able to 1. explain the basic principles involved in titrimetric analysis and inorganic preparations. 2. compare the methodologies of different titrimetric analysis. 3. calculate the concentrations of unknown solutions in different ways and develop the skillto estimate the amount of a substance present in a given solution. 4. assess the yield of different inorganic preparations and identify the end point of various titrations.

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-2	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-3	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3

CO-4	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**1**	**2**	**3**	**3**	**3**	**3**
CO-5	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**1**	**2**	**3**	**3**	**3**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: CHEMICAL LABORATORY SAFETY IN ACADEMIC INSTITUTIONS	**(12P)**
Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal. **Common Apparatus Used in Quantitative Estimation (Volumetric):** Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand.	**CO-1** **BTL-3**
MODULE 2: PRINCIPLE OF QUANTITATIVE ESTIMATION (VOLUMETRIC)	**(12P)**
Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations**;** indicators – types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.	**CO-2** **BTL-3**
MODULE 3: QUANTITATIVE ESTIMATION (VOLUMETRIC)	**(12P)**
Quantitative Estimation (Volumetric): Preparation of standard solution, dilution from stock solution **Permanganometry:** Estimation of sodium oxalate using standard ferrous ammonium sulphate **Dichrometry:** Estimation of ferric alum using standard dichromate (external indicator)Estimation of ferric alum using standard dichromate (internal indicator). **Iodometry:** Estimation of copper in copper sulphate using standard dichromate. **Argentimetry:** Estimation of chloride in barium chloride using standard sodium chloride/ Estimation of chloride in sodium chloride (Volhard's method)	**CO-3** **BTL-3**
MODULE 4: COMPLEXOMETRY AND ESTIMATION	**(12P)**
Complexometry Estimation of hardness of water using EDTA **Estimations** Estimation of iron in iron tabletsEstimation of ascorbic acid.	**CO-4** **BTL-3**
MODULE 5: PREPARATION OF INORGANIC COMPOUNDS	**(12P)**
Preparation of 1. Potash alum, 1. Tetraammine copper (II) sulphate 2. Hexammine cobalt (III) chloride, and 3. Mohr's Salt .	**CO-5** BTL-3
BOOKS	

1.	Nad, A. K.; Mahapatra, B.; Ghoshal, A.; "An advanced course in Practical Chemistry", New Central Book Agency: Kolkata, 3rd ed., 2007.
2.	Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. "Basic Principles of Practical Chemistry", Sultan Chand &Sons: New Delhi, 2nd ed., 1997.
REFERENCE BOOKS	
1	Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; "Vogel's Textbook of Quantitative Chemical Analysis", PearsonEducation Ltd: New Delhi, 6th ed., 2000.
2	
E Resources for Reference	
1.	http://www.federica.unina.it/agraria/analytical-chemistry/volumetric- analysis
2.	https://chemdictionary.org/titration-indicator/
3.	
MOOC	
1.	chem.hbcse.tifr.res.in/wp-content/uploads/2019/10/vogels-textbook-of-quantitative-chemical-analysis-5th-edition.pdf
2.	in.okfn.org/files/2013/07/An-Introductory-Course-of-Quantitative-Chemical-Analysis.pdf

COURSE TITLE	**ROLE OF CHEMISTRY IN DAILY LIFE**			**CREDITS**	**3**
COURSE CODE	**BCT01002**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	**his course explores the applications of chemistry in everyday activities, materials, and household products. It helps students understand how chemical principles influence health, environment, food, and technology in daily life.**				

Course Objective	This course aims at providing an overall view of the 1. Importance of Chemistry in everyday life 2. Chemistry of building materials and food 3. Chemistry of Drugs and pharmaceuticals
Course Outcome	Upon completion of this course, the students will be able to 1. learnaboutthechemicalsusedineverydaylifeaswellasairpollutionandwater pollution. 2. Get knowledge on building materials cement, ceramics, glass and plastics, polythene, PVC, bakelite, polyesters. 3. Acquire information about Food and Nutrition, Carbohydrates, Proteins, Fats, also have an awareness about Cosmetics, Tooth pastes, face powder, soaps and detergents. 4. Discuss about the fertilizers like urea, NPK fertilizers and super phosphate Fuel classifications, liquid and gaseous; nuclear fuel – examples and uses. 5. Have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications.

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: BASICS OF AIR, WATER, AND EVERYDAY CHEMICALS	**(9L)**
General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style. Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution.	**CO-1 BTL-3**

MODULE 2: INTRODUCTION TO BUILDING MATERIALS AND COMMON PLASTICS	**(9L)**
Building materials - cement, ceramics, glass and refractories - definition, composition and application only. Plastics - polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins-preparation and uses only.	**CO-2 BTL-3**

MODULE 3: FUNDAMENTALS OF FOOD, NUTRITION, AND COSMETICS **(9L)**

Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance as food constituents – balanced diet – Calories minerals and vitamins(sources and their physiological importance).Cosmetics–tooth paste,facepowder,soapsanddetergents,shampoos,nailpolish,perfumes-general formulation and preparations – possible hazards of cosmetic use.	**CO-3 BTL-3**
MODULE 4: BASICS OF AGRICULTURAL CHEMICALS AND FUELS	**(9L)**
Chemicals in food production – fertilizers - need, natural sources; urea, NPK fertilizers and super phosphate. Fuel–classification-solid, liquid and gaseous; nuclear fuel examples and uses.	**CO-4 BTL-3**
MODULE 5: INTRODUCTION TO DRUGS, COLOR CHEMICALS, AND EXPLOSIVES	**(9L)**
Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals-pigments and dyes-examples and applications. Explosives - classification and examples.	**CO-5** BTL-3

BOOKS	
1.	B. K, Sharma, "Industrial Chemistry", GOEL publishing house, Meerut, 16th edition, 2014.
2.	Jaya shree Ghosh, "A textbook of pharmaceutical chemistry" S Chand publishing, 2012.
REFERENCE BOOKS	
1	W.A. Poucher, Joseph. A. Brink, Jr. "Perfumes, Cosmetics and Soaps", Springer, 2000.
2	A.K.De, "EnvironmentalChemistry", New Age International Public Co., 1990.
3	
4	
E Resources for Reference	
1.	Importance of Chemistry in Everyday Life - GeeksforGeeks
2.	dl.icdst.org/pdfs/files4/245078a9e1ffa18cdbd78bd9f50285d9.pdf
3.	
MOOC	
1.	SATHEE: Chemistry In Everyday Life
2.	Chemistry in Everyday Life: More Than Just Formulas | Exploring Real-Life Applications of Chemistry

COURSE TITLE	**CALCULUS AND ALGEBRA**			**CREDITS**	**3**
COURSE CODE	**BMA01019**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**

First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance *	
15%	15%	10%	5%	5%	50%

Course Description	**To expose the students to the fundamental concepts in calculus and algebra.**
Course Objective	1. To understand and perform operations with matrices and solve system of equations. 2. To analyze polynomial equations and their roots, including transformations and their properties. 3. To apply differential calculus in analyzing rates of change, maxima, minima, and functions of multiple variables. 4. To apply integral calculus to compute areas, arc lengths, surface areas, and to evaluate improper integrals. 5. To employ Laplace transforms to solve differential equations and problems involving periodic functions.
Course Outcome	Upon completion of this course, the students will be able to 1. Solve linear equations using matrices and find eigenvalues and eigenvectors. 2. Solve algebraic equations, understand root–coefficient relationships, and use basic transformations. 3. Find derivatives, maxima and minima, and partial derivatives for practical applications 4. Evaluate all types of integrals and compute areas, arc lengths, and surface areas. 5. Apply Laplace transforms to solve differential equations and study periodic functions.

Prerequisites: Knowledge in fundamentals of mathematics at higher secondary level.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	3	1	1	-	-	-	-	-	2	2	2	-
CO-2	2	-	1	2	1	1	-	-	-	-	-	1	1	2	-
CO-3	2	-	1	2	1	1	-	-	-	-	-	1	1	2	-
CO-4	2	-	1	2	1	1	-	-	-	-	-	1	1	2	-
CO-5	2	-	1	2	1	1	-	-	-	-	-	1	1	2	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: MATRICES (6L+3T)

Introduction – Types of Matrices – Determinants - Solution of System of Equations – Cramer's Rule – – Inverse of a Matrix : Matrix Inversion Method – Eigen Values and Eigen Vectors. **Suggested Readings:** Problems on applications of eigen values and eigen vectors in determining the theoretical limit in a communication system.	**CO-1** **BTL-3**
MODULE 2: THEORY OF EQUATIONS	**(6L+3T)**
Roots of an equation- Relations connecting the roots and coefficients- Transformations of equations - Character and position of roots - Descartes's rule of signs - Symmetric function of roots - Reciprocal equations. **Suggested Readings:** Reciprocal Equations	**CO-2** **BTL-3**
MODULE 3: DIFFERENTIAL CALCULUS	**(6L+3T)**
Functions, Graph of functions - Limit of a function, Continuity, Limits at infinity, Derivatives of functions - Maxima and Minima of functions of single variable – Two variable functions - Partial Derivatives. **Suggested Readings:** Problems on displacement, velocity, acceleration, angles of inclination on a surface using differential calculus.	**CO-3** **BTL-3**
MODULE 4: INTEGRAL CALCULUS	**(6L+3T)**
Fundamental theorem of Calculus - Indefinite integrals - Improper integrals - Arc Length -Area of Region - Area of surface of revolution using line integral. **Suggested Readings:** Improper Integrals in Quantum Chemistry, Surface Area in Molecular Models	**CO-4** **BTL-3**
MODULE 5: LAPLACE TRANSFORMS	**(6L+3T)**
Laplace Transforms: Definition – Laplace Transforms of elementary functions – First Shifting Theorem – Inverse Laplace Transforms of elementary functions – Inverse Laplace Transforms using Partial Fraction. **Suggested Readings:** Linearity Property, Periodic Functions	**CO-5** BTL-3

BOOKS	
1.	P.R. Vittal, "Allied Mathematics", Margham Publications, Chennai, 2012.
2.	S. Narayanan and T. K. Manickavasagam Pillai, "Calculus Vol III", S. Viswanathan Printers and Publishers Pvt. Ltd, Chennai, 2009.
REFERENCE BOOKS	
1	P. Kandasamy and K. Thilagavathy, "Mathematics for B.Sc. Branch I -Vol. I, S. Chand and Company Ltd, New Delhi, 2014.
2	Grewal, B. S. "Higher engineering mathematics". Khanna Publishers, 2012.
3	V. Sundaram and R. Balasubramanian, "Linear Algebra and Calculus", Saras Publications, Chennai, 2015.
4	P. K. Mittal and S. Chand, "Mathematical Analysis and Calculus", S. Chand & Company Ltd, New Delhi, 2005.
E Resources for Reference	
1.	https://math.libretexts.org/Bookshelves/Calculus/Map%3A_Calculus__Early_Transcendentals_(Stewart)
2.	https://openstax.org/details/books/calculus-volume-1

3.	https://tutorial.math.lamar.edu/Classes/CalcII/CalcII.aspx
MOOC	
1.	https://www.coursera.org/learn/introduction-to-calculus
2.	https://onlinecourses.swayam2.ac.in/cec24_ma10/preview

COURSE TITLE		**COMMUNICATION SKILLS**				**CREDITS**	**2**
COURSE CODE		**GLS51001**	**COURSE CATEGORY**		**HS**	**L - T – P – S**	**2 – 0 – 1 – 1**
Version	**0.0**	**Approval Details**				**LEARNING LEVEL**	**BTL 4**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment	**Second Periodical Assessment**	**Weekly assignment/ lab record and viva as approved by the Department Examination Committee "DEC"**	**Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"**	**Attendance**	**ESE Theory**	**ESE Practical**
15 %	**15 %**	**10 %**	**5 %**	**5 %**	**25 %**	**25 %**

Course Description	**The course has been designed to improve the communication competency of the students. The course builds on students' English language skills by engaging them in listening, speaking and grammar learning activities (LSRW) that are relevant to authentic contexts. This course trains the students how to communicate accurately, appropriately and fluently in professional and social situations. The course is framed so that the students can appear for Cambridge B1 Preliminary exams and also enable them to get a certification.**
Course Objective	1. To acquire self-confidence by which the learner can improve upon their informative listening skills by an enhanced acquisition of the English language. 2. To provide an environment to Speak in English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate. 3. To equip the students to Read, comprehend and answer questions based on literary, scientific and technological texts. 4. To enhance the writing skills of the students via training in instructions, recommendations, checklists, process-description, letter-writing and report writing. 5. To equip the learners in analyzing and applying creative thinking skills and participate in brainstorming, mind-mapping, audiovisual activities and excel in employability skills.
Course Outcome	Upon completion of this course, the students will be able to

	1. Acquire the accuracy through the knowledge of Syntax. 2. Demonstrate the skill of using the vocabulary and use it in sentences appropriately. 3. Infer texts and improvise its usage. 4. Illustrate language acquisition skills through formal correspondence. 5. Analyse and transcode the data and interpret it in text format.

Prerequisites: Plus Two English-Intermediate Level

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-2	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-3	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-4	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-5	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 : ENGLISH FOR EMPLOYABILITY	**(6L + 3P)**
Grammar : 1. Parts of Speech – Identification and Transformation 2. Kinds of Sentences – Identification and Transformation 3. Sentence Pattern – Framing Sentences 4. Tenses – Rules & its usage – Present simple and present continuous; time expressions; state verbs – Past simple ; regular and irregular verbs and spelling of past simple forms ; past continuous. **Vocabulary :** 1. Job titles and describing jobs ; names of company departments 2. Computer terms; email and website terms. 3. Headings for CVs Describing application Procedures **Writing :** 1. Writing emails – formal and informal – phrases for emails & letters. 2. Writing a covering letter with a resume for a job application. **Reading :** Reading about Job and Company : 1. Changing places : job swapping at work. 2. The power of word of mouse : an article on the power of online customer options 3. Haier : an article about the history of a Chinese Company. 4. What kind of company Culture would suit you ? reading answering a quiz. **Lab Activities(Speaking) :** 1.Self Introduction. 2. Describing jobs ; asking other people about their jobs. 3. Asking about the history of a company ; past simple questions 4. Asking questions about companies and jobs. **Lab Activities(Listening) :** 1. Being a PA 2. Growing Pains : an interview with a business consultant about company's Growth. 3. Describing changes in a company : a Conversation on the phone.	**CO-1** **BTL-2**
MODULE 2 : ENGLISH FOR MARKETING	**(6L + 3P)**
Grammar: 1. Concord - Understanding Subject Verb agreement – Identifying the error and Correcting 2. Active and Passive Voice – Identifying the voices and Transforming Active to passive and passive to active 3. Modal Verbs – Using to express modalities – in active and passive voices 4. Words to Describe causes and effects. 5. Prepositions **Vocabulary : 1.** Vocabulary to describe objects; component parts, shapes, dimensions, materials Describing problems with equipment 2. Verbs to Describe process 3. Vocabulary to talk about advertising and marketing, Language to describe cause and effect. **Writing :** 1. Topic Sentence 2. Paragraph Writing 3. Developing a story with the hints	**CO-2** **BTL-3**

4. Promotional letter(Email) **Reading :** Product Description and Advertisement : 1. Problems with equipment : emails and headings on a form. 2. Waratah : an article on an Australian clothing company. , Short Texts : Notices, Notes and messages 3. Selling your product abroad; an article , Workplace signs and notices 4. Descriptions of advertising media, Singapore airlines; an article on the branding of an airline. **Lab Activities(Speaking) :** 1.Role Play – Telephone call to a supplier, 2. Describing Objects **Lab Activities(Listening) :** 1. Describing dimensions of products : Conversations with colleagues and suppliers. – The Gizmo game : listening to the uses of a gadget. 2. Channel No.5 : an interview about a production process 3. Telephone conversations : information about orders and deliveries. 4. Descriptions of how a product is advertised.	
MODULE 3 : BUSINESS CORRESPONDENCE	**(6L + 3P)**
Grammar : 1. Tenses – Present continuous for future arrangements; will and going to future forms 2. Using discourse markers ; Sentence starters - Contrast & similarity words, 3. Degrees of Comparison – Framing sentences with appropriate adjectives and adverts – transformation from one degree to another degree. 4. Infinitives and gerunds – using infinitives and gerunds in sentences as different elements. 5. Conditionals – Three types of conditionals **Vocabulary :** 1.Vocabulary for travel 2. Synonyms and Antonyms 3. Employment Vocabulary **Writing :** 1. A letter(Email) of invitation – Accepting the invitation and declining the invitation. **Reading :** Transport, Working Holidays and Conferences : Travel Arrangements : notices and short messages : Eurostar : an article on train travel. 2. Netflix : an article about a company's holiday policy; thinking outside the box: an article on offsite meetings 3. Short Texts : Feedback on conferences **Lab Activities(Speaking) :** Discussion: How to make decisions **Lab Activities(Listening) :** 1. Making and changing appointments : Voicemail messages and phone conversations ; Future intentions and predictions : Short Extracts. 2. A travel Anecdote 3. Half Holidays: a conversation between two employees. 4. Discussing possible venues for a conference : a conversation between colleagues; a welcome speech at a conference.	**CO-3** **BTL-3**
MODULE 4 : ENGLISH FOR BUSINESS RELATIONSHIPS	**(6L + 3P)**
Grammar : 1. Writing Instructions and Recommendations – Transforming instruction to recommendation and recommendation to instruction 2. Expressions of quantity – semi-negative words 3. Present Perfect : time expressions : present perfect versus Past simple. 4. Reported Speech – Direct and Indirect Speeches – Identification and Transformation **Vocabulary :** 1. Affixes 2. Countable and Uncountable nouns 3. Global Management **Writing :** 1.Memo 2. Notice with agenda 3. Email : Requesting information **Reading :** Corporate gift-giving, New places, New people, Team Building and Thinking globally : 1. Career Advice : letters to an advice column 2. Promotional gifts : an article 3. Descriptions of team building events; Kaizen : an article 4. Global HR management : an Article. **Lab Activities(Speaking):** Role Play : 1. Interviewing someone about a job change 2. Discussion : Planning a team building event 3. Promoting a city : giving a speech. **Lab Activities(Listening) :** 1. An interview with someone who has changed career 2. An interview about corporate gift giving 3. Creating good teams : a Presentation 4. Working an international Team : short Extracts.	**CO-4** **BTL-3**
MODULE 5 : ENGLISH FOR PRESENTATION	**(6L + 3P)**

Grammar : 1. Adjectives and adverbs 2. Pronouns and Reference Words 3. Types of Sentences – Simple, Compound and complex Sentences – Identification and transformation. **Vocabulary :** 1. Describing Trends, 2. Finance Vocabulary, 3. Stocks and Shares, 4. Collocation - sets and money **Writing** : 1. Transcoding – Converting an image (Linegraph, piechart, bar chart, flowchart tree diagram etc.,) into a paragraph – Converting a paragraph into an image (Linegraph, piechart, bar chart, flowchart tree diagram etc.,) 2. Summary writing **Reading :** Describing Statistics, Company finances, investments and starting up : 1. Interpreting bar charts 2. Café Coffee Day : an article on the growth of the Indian coffee shop. 3. Shares and the stock exchange: a web page; short articles from the financial news; men and women investments : an article 4. Teenage entrepreneus : reading and comparing two articles; Kalido: an article on funding. **Lab Activities(Speaking) :** 1. Describing figures and trends 2. Discussing qualities needed in candidates for a job vacancy **Lab Activities(Listening) :** 1. Listening to statistical information : short extracts 2. An interview with the employee of a company that helps failing business 3. An interview with someone who works in investor relations. 4. Radio interview : marketing director of a business support service.	**CO-5** **BTL-4**
TEXT BOOK	
1	Whitby, Norman (2019). Cambridge English Business Benchmark, Pre-intermediate and Intermediate. Cambridge University Press. India (Pages 208)
REFERENCE BOOKS	
1.	Murphy, Raymond (2021). Essential English Grammar, Cambridge University Press. India (Pages 300)
2.	Redman, Stuart (2020). English Vocabulary In Use: Pre - Intermediate And Intermediate. Cambridge University Press. India (Pages 264).
3.	Bikram K. Das. (2019) An Introduction to Professional English and Soft Skills with audio CD, Cambridge University Press. India (Pages 272).
4.	John, Dolly., (2018), English for Life and the Workplace Through LSRW&T Skills, Pearson Publications. India (Pages 263).
E BOOKS	
1.	https://www.cambridge.org/gb/files/9116/4138/4615/A1_Student_Book.pdf
2.	https://www.cambridge.org/gb/files/1416/4138/4681/A1_Workbook.pdf
3.	https://www.cambridge.org/gb/files/7216/4138/1999/A2_Student_Book.pdf
4.	https://www.cambridge.org/gb/files/6816/4138/2072/A2_Workbook.pdf
MOOC	
1.	https://www.edx.org/professional-certificate/tsinghuax-english-communication-skills
2.	https://www.britishcouncil.org.tr/en/english/mooc/english-for-the-workplace

COURSE TITLE		TAMIL ART AND CULTURE			CREDITS	1
COURSE CODE		GLS11001	COURSE CATEGORY	HS	L-T-P-S	1-0-1-2
Version	0.0	Approval Details			LEARNING LEVEL	BTL- 2

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation/Lab Records as approved by the Department Examination Committee "DEC"	Attendance	ESE	
					Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	**Tamil arts, culture and language skills will be well known among the students by studying this foundational course. The various aspects of Tamil history, art, culture, literature, poetry and language would be informative and useful. This Course will create interest in learning Tamil art and culture among students.**
Course Objective	1. Enables students to listen, speak, read and write in Tamil in better manner. 2. Develops interest in learning Tamil art and culture among students. 3. Enhances students to use Tamil for themselves in any situation. 4. Provides students the opportunity to learn Tamil literature. 5. Learning about Tamil art and culture, the students get connected with the culture and tradition of the community.
Course Outcome	1. The interest in art and culture among the students will improve and they will show interest in learning Tamil literature. 2. Students will develop skills in reading essays, poems, short stories etc. in a comprehensive manner. 3. By learning Tamil language with artistic and cultural thinking, they can fulfill their living needs accordingly to the place they live-in. 4. By studying Tamil art and culture, students learn about the history of Tamil literature and the art and cultural customs associated with Tamil people's life. 5. This course will help the students to improve their quality of life by learning about the life style, culture, civilization and development of ancient Tamils.

Prerequisites: Plus Two -Intermediate Level

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-2	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-3	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-4	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-5	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

Module-1 HISTORY OF TAMILIAN	**(6L)**
Five types of land - Prototype - Theme - Adjective - Civilization - Glossary Explanation, Food, dress, shelter, accessories of ancient Tamils - Ancient warfare - Trade - Industries - Morality of ancient Tamil - Theft - Draft - Chaste life. Classroom Procedures: 1. Lecture Method 2. Question-Answer Method 3. Fill in the missing letters. 4. Group discussion 5. Classroom test	**CO-1** **BTL-1**
Module– 2 CULTURE AND CUSTOMS OF TAMILIAN	**(6 L)**
Beliefs – Rituals – Religious Worship – Festivals – Religion – Saivism – Vaishnavism – Jainism – Buddhism – Islam – Christianity. Classroom Procedures: 1. Lecture Method 2. Question-Answer Method 3. Fill in the missing letters. 4. Group discussion 5. Classroom test	**CO-2** **BTL-2**
Module– 3 TAMIL ART FORM	**(6 L)**
Ancient Tamil Architecture (Temples, Forts), Music and Instruments (Leather Instruments, Perforators, String Instruments, Kanjakarui, Mittakarui), Sculpture (Temple Sculptures), Painting (Chitanna Vasal Painting) Folk Art	**CO-2** **BTL-2**

(Silamdance, Myilatam, Violatam, Poikal, Equestrianism,) Processes: 1. Explanation 2. Questioning 3. Recitation of poetry 4. Story telling 5. Delivery	
Module- 4 **TRADITIONAL SPORTS OF TAMILIAN**	**(6 L)**
Tamil Sp0rts - Kabaddi, Ballanguzhi, Bandi playing, Thalam, Adubuliyatam, Chess. Classroom Procedures: 1. Teaching dialogues by acting out skits.2. Storytelling3. Delivery	CO-2 BTL-2
Module- 5 **TAMIL LITERATURE**	**(6 L)**
Thirukkural - Discipline (Song - 14), Education (Song - 40), Kurunthogai (Song No. - 40), Ingurunuru (Song No. - 22), Kalithogai (Song No. - 133), Poorananuru (Song No. - 192) Classroom Activities: 1. Poetry Recitation Competitions 2. Classroom Tests	CO-3 BTL-3

TEXT BOOK	
1.	J. DevaneyapaBhavanar - Ancient Tamil Civilization and Culture, Tamilman Publishing House, Chennai. 2000.
2.	A. Dakshinamurthy - Tamil Civilization and Culture, Jaffna Publication, West Anna Nagar, Chennai - 40, 2014.
REFERENCE BOOKS	
1.	MailaiSeeniVenkatasamy - Fine Arts, Phoombukar Publishing House, Chennai-08, 2014.
2.	K. Balaraman - Palanthamil Science, World Tamil Research Institute, Chennai. 2009.
E-REFERENCES	
1	https://www.tamilvu.org/ta/library-lA417-html-lA417con-147465

<table>
<tr><td>COURSE TITLE</td><td colspan="3">ENVIRONMENTAL SCIENCE AND SUSTAINABLE DEVELOPMENT</td><td>CREDITS</td><td>2</td></tr>
<tr><td>COURSE CODE</td><td>GGE51003</td><td>COURSE CATEGORY</td><td>VA</td><td>L-T-P-S</td><td>2-0-0-2</td></tr>
<tr><td>Version</td><td>1.0</td><td>Approval Details</td><td></td><td>LEARNING LEVEL</td><td>BTL-3</td></tr>
<tr><td colspan="6">ASSESSMENT SCHEME</td></tr>
<tr><td>First Periodical Assessment</td><td>Second Periodical Assessment</td><td>Practical Assessments</td><td>Observation / Lab records as approved by the Department as approved by the Department Examination Committee ‘DEC”</td><td>Attendance</td><td>ESE</td></tr>
<tr><td>15%</td><td>15%</td><td>10%</td><td>5%</td><td>5%</td><td>Theory 25%
Practical 25%</td></tr>
<tr><td>Course Description</td><td colspan="5">To expose the students to the basics of environmental science and sustainable development.</td></tr>
<tr><td>Course Objective</td><td colspan="5">1. To make the students aware of the natural resources and to educate them to understand the need for preserving the resources.
2. To provide knowledge on the various aspects of environmental pollution and issues.
3. To provide basic knowledge and concepts of sustainability.
4. To educate the students about the concepts of sustainable habitat.
5. To give a broad knowledge on environmental management system.</td></tr>
<tr><td>Course Outcome</td><td colspan="5">Upon completion of this course, the students will be able to
1. Recognize the effects of over exploitation of natural resources and their impact on day-to-day life on earth.
2. Apply the sustainable solutions for environmental pollution and issues.
3. Implement the concepts of sustainability in the product development.
4. Use appropriate methods for designing green house and maintaining sustainable cities, transport system, industries, etc.
5. Manage the environment for sustainable product development.</td></tr>
<tr><td colspan="6">Prerequisites: Basic knowledge of science and environment.</td></tr>
<tr><td colspan="6">CO, PO AND PSO MAPPING</td></tr>
</table>

CO	PO - 1	PO- 2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO- 8	PO- 9	PO - 10	PO- 11	PO- 12	PSO- 1	PSO- 2	PSO-3
CO-1	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**1**	**2**	**-**	**-**	**3**	**-**	**1**	**3**
CO-2	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**1**	**2**	**-**	**-**	**3**	**-**	**1**	**3**
CO-3	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**1**	**2**	**-**	**-**	**3**	**-**	**1**	**3**
CO-4	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**1**	**2**	**-**	**-**	**3**	**-**	**1**	**3**
CO-5	**1**	**-**	**1**	**-**	**1**	**2**	**1**	**1**	**2**	**-**	**-**	**3**	**-**	**1**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: NATURAL RESOURCES	**(6L)**
Introduction - Forest resources: Use and over-exploitation – Water resources: Use and over-utilization – Mineral resources: Use and exploitation – Food resources: World food problems, effects of modern agriculture – Energy resources: conventional and nonconventional, solar energy, fuel cells, wind energy, hydro plants, bio-fuels, Energy derived from oceans, geothermal energy – Land resources: Use and over-exploitation – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study – Documentation of nearby environmental assets – river / forest / grassland / hill / mountain.	**CO-1** **BTL-3**
MODULE 2: ENVIRONMENTAL POLLUTION AND ISSUES	**(6L)**
Air pollution, effects of air pollutions; Water pollution – sources, sustainable waste water treatment; Solid waste – sources, impacts, zero waste concept, 3R concept, Global environmental issues – Resource degradation, climate change, global warming, ozone layer depletion – Regional and local environmental issues – Carbon credits and carbon trading, carbon foot print. Field Study - Observe a pond nearby and analyze the different measures that can be adopted for its conservation	**CO-2** **BTL-3**
MODULE 3: SUSTAINABILITY	**(6L)**
Introduction, need of sustainability – Social, environmental and economic sustainability concepts – sustainable development, Nexus between technology and sustainable development, challenges for sustainable development – multilateral environmental agreements and protocols – clean development mechanism (CDM) – Environmental legislations in India – water act, air act. Field Study - Assessment of sustainability in your neighbourhood in education / housing / water resources / energy resources / food supplies/ land use / environmental protection, etc.	**CO-3** **BTL-3**
MODULE 4: CONCEPTS OF SUSTAINABLE HABITAT	**(6L)**
Green buildings: material for sustainable design, green building certification, methods for increasing energy efficiency of buildings – sustainable urbanization - sustainable transport – Industrialization and poverty reduction – Industrial processes: material selection, pollution prevention, industrial ecology, industrial symbiosis. Assignment – Explore the different methods that can be adopted for maintaining a sustainable transport system in your city.	**CO-4** **BTL-3**

MODULE 5: ENVIRONMENTAL MANAGEMENT	(6L)
Environmental management: Principles and strategies, Indicators of environmental quality – economic valuation - environmental cost-benefit analysis – Fiscal incentives in pollution control and management – Environmental management system: ISO 14000, Life Cycle Analysis (LCA) – scope and goal, bio-mimicking – Environmental Impact Assessment (EIA) – Procedures of EIA in India. Assignment – Conducting an EIA study of a small project (example, construction of house, road, bridge, etc.) in your local area.	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Basu, M., Savarimuthu, X. "Fundamentals of Environmental Studies", Cambridge University Press, 1st Edition, 2017.
2.	Bhavik R. Bakshi, "Sustainable Engineering: Principles and Practice", Cambridge University Press, 1st Edition, 2019.
3.	Mulligan, C. "Sustainable Engineering: Principles and Implementation", CRC Press, 1st Edition, 2020.
REFERENCE BOOKS	
1.	Wasewar, K. L., Rao, S. N. "Sustainable Engineering, Energy, and the Environment Challenges and Opportunities", CRC Press, 1st Edition, 2022.
2.	Singh, J.S., Singh, S.P., Gupta, S. R. "Ecology, Environmental Science and Conservation". S. Chand Publishing Company, New Delhi, 2017.
E BOOKS	
1.	https://www.hzu.edu.in/bed/E%20V%20S.pdf
2.	https://library.oapen.org/handle/20.500.12657/33379
MOOC	
1.	https://www.my-mooc.com/en/categorie/environmental-science
2.	https://www.coursera.org/specializations/sustainable-cities

COURSE TITLE	**FUNDAMENTALS OF ORGANIC CHEMISTRY**			**CREDITS**	**4**
COURSE CODE	**BCT01003**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the**	**Attendance***	

			Department Examination Committee "DEC""		
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	**This course builds on core chemical concepts with emphasis on basics of organic chemistry, hydro carbon chemistry, halogen derivatives and phenols. The course strengthens theoretical understanding and problem-solving skills for advanced chemistry studies.**
Course Objective	This course aims at providing an overall view of the 1. fundamental concepts of organic chemistry 2. Chemistry of hydrocarbons 3. Basic chemistry of halo-organic compounds, phenol and other aromatic alcohols. 4. Preparation methods for phenols and alcohols. 5. Properties of phenols and alcohols.
Course Outcome	Upon completion of this course, the students will be able to 1. explain the concept of organic chemistry. 2. discuss the reactions of aliphatic and aromatic hydrocarbons and strength of acids. 3. classify hydrocarbons, and reaction mechanisms of aliphatic and aromatic hydrocarbons 4. describe the chemistry, reactions, and uses of halo-organic compounds, phenols, and aromatic alcohols. 5. analyse the preparation methods and properties of phenols and alcohols.

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: BASIC CONCEPTS IN ORGANIC CHEMISTRY AND ELECTRONIC EFFECTS (9L+3T)

Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes. Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects. Resonance – resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance. Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane. Types of organic reactions - addition, substitution, elimination and rearrangements.	**CO-1** **BTL-3**
MODULE 2: HYDRO CARBON CHEMISTRY-I	**(9L+3T)**
Petroproducts: Fractional distillation of petroleum; cracking, isomerisation, alkylation, reforming and uses. **Alkenes**-Nomenclature, general methods of preparation – Mechanism of elimination reactions – E1 and E2 mechanism - factors influencing – stereochemistry – orientation – Hofmann and Saytzeffrules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, Kharasch effect, oxidation reactions–hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization. **Alkadienes -** Nomenclature - classification – isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes– Diels–Alder reactions – polymerisation – polybutadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene. **Alkynes -** Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation. **Cycloalkanes -** Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations. Conformational analysis of cyclohexane, mono and di substituted cyclohexanes. Geometrical isomerism in cyclohexanes.	**CO-2** **BTL-3**
MODULE 3: HYDRO CARBONCHEMISTRY-II	**(9L+3T)**
Benzene: Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenations. Friedel-Craft's alkylation and acylation. Monosubstituted and disubstituted benzene -Effect of substituent–orientation and reactivity. **Polynuclear Aromatic hydrocarbons**: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at o-,p- or m- position – reduction, oxidation – uses. Anthracene – synthesis by Elbs reaction, Diels – Alder reaction and Haworth synthesis; physical properties; reactions - Diels-Alder reaction, preferential substitution at C-9 and C-10; uses.	**CO-3** **BTL-3**
MODULE 4: HALOGEN DERIVATIVES	**(9L+3T)**
Aliphatic halogen derivatives Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – S_N1, S_N2 and S_Ni mechanisms with stereochemical aspects and effect of solvent. **Di, Tri &Tetra Halogen derivatives:** Nomenclature, classification, preparation, properties and applications.	**CO-4** **BTL-3**

Aromatic halogen compounds Nomenclature, preparation, properties and uses Mechanism of nucleophilic aromatic substitution–benzyne intermediate. **Aryl alky lhalides** Nomenclature, benzyl chloride–preparation–properties and uses **Alcohols:** Nomenclature, classification, preparation, properties, use; conversions– ascent and descent of series; test for hydroxyl groups. Oxidation of diols by per iodic acid and lead tetra acetate.	
MODULE 5: PHENOLS	**(9L+3T)**
Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raching process; properties – acidic character and effect of substitution on acidity. Reactions–Fries, claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Gatermann synthesis, Libermann, nitro reaction, phthalein reaction. Resorcinol, quinol, picric acid – preparation, properties and uses. **Aromatic alcohols** Nomenclature, benzyl alcohol– methods of preparation–hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reactions – reaction with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride, hydrogen iodide, oxidation–substitution on the benzene nucleus, uses. Thiols: Nomenclature, structure, preparation and properties.	**CO-5** BTL-3

BOOKS	
1.	Bahl B S, Arul Bhal, "Advanced Organic Chemistry", S.Chand and Company, New Delhi, 3rd Edi., 2003.
2.	Bruce, P.Y. and Prasad K.J.R. "Essential Organic Chemistry", Pearson Education: New Delhi, 2008.
REFERENCE BOOKS	
1	A. Carey Francis, "Organic Chemistry", Tata McGraw- Hill Education Pvt., Ltd., New Delhi, seventh edition, 2009.
2	J.A. Joule, and G.F. Smith, "Heterocyclic Chemistry", Wiley,5th Edition,2010.
3	P.L. Soni, and H.M. Chawla, "Text Book of Organic Chemistry", New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007.
4	
E Resources for Reference	
1.	https://onlinecourses.nptel.ac.in
2.	http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding
3.	Organic Chemistry 1 Course | Science Prerequisites | UNE Online
MOOC	
1.	http://nptel.ac.in/courses/104101090/
2.	nptel.ac.in/courses/104106119

COURSE TITLE	QUALITATIVE ORGANIC ANALYSIS			CREDITS	2
COURSE CODE	BCT01401	COURSE CATEGORY	PC	L-T-P-S	0-0-4-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

CIA					ESE
Experimental	Calculation	Result	Viva	Record	
20%	10%	10%	5%	5%	50%

Course Description	**Qualitative Organic Analysis focuses on identifying organic compounds through systematic detection of functional groups and characteristic reactions. The course develops skills in classical organic analysis, interpretation, and laboratory techniques.**
Course Objective	This course aims at providing knowledge on 1. Laboratory safety 2. Handling glass wares 3. Analysis of organic compounds 4. Preparation of derivatives. 5. Study the principle of the experiment.
Course Outcome	Upon completion of this course, the students will be able to 1. observe the physical state, odour ,colour and solubility of the given organic compound. 2. identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis. 3. compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind it. 4. exhibit a solid derivative with respect to the identified functional group.

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-2	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-3	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3

CO-4	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**1**	**2**	**3**	**3**	**3**	**3**
CO-5	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**1**	**2**	**3**	**3**	**3**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: LABORATORY SAFETY, EQUIPMENT, AND GLASSWARE	**(12P)**
Safety rules, symbols and first-aid in chemistry laboratory. Basic ideas about Bunsen burner, its operation and parts of the flame. Chemistry laboratory glassware –basis information and uses.	**CO-1** **BTL-3**

MODULE 2: QUALITATIVE ORGANIC ANALYSIS	**(48P)**
Preliminary examination, detection of special elements -nitrogen, sulphur and halogens Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests • Confirmation of functional groups • Monocarboxylic acid, dicarboxylic acid • Monohydric phenol, polyhydric phenol • aldehyde, ketone, ester • carbohydrate (reducing and non-reducing sugars) • primary, secondary, tertiary amine • monoamide, diamide, thioamide • anilide, nitro compound • Preparation of derivatives for functional groups.	**CO-2-5** **BTL-3**

BOOKS	
1.	Manna, A.K. “Practical Organic Chemistry”, Books and Allied: India, 2018.
2.	Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. “Basic Principles of Practical Chemistry”, Sultan Chand: New Delhi, 2nd Edi., 2012.
REFERENCE BOOKS	
1	Gurtu, J.N; Kapoor , R. “Advanced Experimental Chemistry (Organic)”, Sultan Chand: New Delhi, 1987.
2	Furniss ,B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. “Vogel’s Textbook of Practical organic Chemistry”, Pearson: India, 5th Edi., 1989.
E Resources for Reference	
1.	https://www.vlab.co.in/broad-area-chemical-sciences
2.	Qualitative and Quantitative Analysis of Organic Compounds MCQ [Free PDF] - Objective Question Answer for Qualitative and Quantitative Analysis of Organic Compounds Quiz - Download Now!
3.	
MOOC	
1.	IIT-JAM - Course on Qualitative Organic Analysis by Unacademy
2.	Qualitative Analysis of Organic Compounds.

COURSE TITLE	BIOCHEMISTRY			CREDITS	3
COURSE CODE	BCT01004	COURSE CATEGORY	PC	L-T-P-S	2-1-0-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance*	
15%	15%	10%	5%	5%	50%

Course Description	**Biochemistry examines the chemical basis of life by exploring biomolecules, metabolic pathways, and cellular processes. The course provides foundational understanding of how chemical principles govern biological functions.**
Course Objective	This course aims at providing an overall view of the 1. relationship between biochemistry and medicine, composition of blood. 2. Structure and properties of amino acids, peptides, enzyme, vitamins and proteins. 3. Biological functions of proteins, enzymes, vitamins and hormones. 4. Biochemistry of nucleic acids and lipids. 5. Metabolism of lipids
Course Outcome	Upon completion of this course, the students will be able to 1. Explain molecular logic of living organisms, composition of blood and blood coagulation. 2. Explain synthesis and properties of amino acids, determination of structure of peptides and proteins. 3. Explain factors influencing enzyme activity and vitamins as coenzymes. 4. explain RNA and DNA structure and functions. 5. explain biological significance of simple and compound lipids.

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

CO-3	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-4	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-5	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: LOGIC OF LIVING ORGANISMS	**(9L)**
Relationship of Biochemistry and Medicine. Blood -Composition of Blood, Blood Coagulation – Mechanism. Hemophilia and Sickle Cell Anemia Maintenance of pH of Blood –Bicarbonate Buffer, Acidosis, Alkalosis.	**CO-1** **BTL-3**
MODULE 2: PEPTIDES AND PROTEINS	**(9L)**
Amino acids – nomenclature, classification – essential and Non- essential; Synthesis – Gabriel Phthalimide, Strecker; properties – zwitter Ion and iso electric point, electrophoresis and reactions. **Peptides** – peptide bond – nomenclature – synthesis of simple peptides – Solution and solid phase. Determination of structure of peptides, N-Terminal analysis –Sanger's & Edmann method; C terminal analysis- Enzymic method. **Proteins** – classification based on composition, functions and structure; Properties and reactions – colloidal nature, coagulation, hydrolysis, oxidation, denaturation, renaturation; colour tests for proteins; structure of proteins–primary, secondary, tertiary and quaternary. Metabolism of amino acids– general aspects of metabolism (a brief outline); urea cycle.	**CO-2** **BTL-3**
MODULE 3: ENZYMES AND VITAMINS	**(9L)**
Nomenclature and classification, characteristics, factors influencing Enzyme activity–mechanism of enzyme action – Lock and key hypothesis, Koshland's induced fit model. Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation. Vitamins as coenzymes – functions of TPP, lipoic acid, NAD, NADP, FMN, FAD, pyridoxal phosphate, CoA, folic acid, biotin, cyanocobalamin.	**CO-3** **BTL-3**
MODULE 4: AMINO ACIDS	**(9L)**
Components of nucleic acids – nitrogenous bases and pentose sugars, Structure of nucleosides and nucleotides, DNA – structure & functions; RNA – types – structure - functions; biosynthesis of proteins **Hormones –** Adrenalin and thyroxine—chemistry, structure and functions (No structure elucidation).	**CO-4** **BTL-3**
MODULE 5: LIPIDS	**(9L)**
Occurrence, biological significance of fats, classification of lipids. **Simple lipids** – Oils and fats, chemical composition, properties, reactions – hydrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils and fats– saponification number, iodine number, acid value, R. M. value. Distinction between animal and vegetable fats. **Compound lipids** – Lipoproteins - VLDL,LDL,HDL, chylomicrons– biological significance. Cholesterol–occurrence, structure, test, physiological activity. Metabolism of lipids: β-oxidation of fatty acids.	**CO-5** BTL-3
BOOKS	

1.	Jain. M.K.; Sharma, S.C, "Modern Organic Chemistry, Vishal Publications: New Delhi, 2017.
2.	Veerakumari. L, "Biochemistry", M J P Publications: Chennai, 1st ed., 2004.
REFERENCE BOOKS	
1	Conn. E.E.; Stumpf. P.K, "Outline of Biochemistry, Wiley Eastern: New Delhi, 5th ed., 2002.
2	Lehninger. A.L, "Principles of Biochemistry", CBS Publisher: Delhi, 2nd ed., 1993.
3	Chatterjea. M. N.; Shinde. R., "Text book of Medical Biochemistry, Jay pee Brothers: New Delhi, 5th ed., 2002.
4	
E Resources for Reference	
1.	http://library.med.utah.edu/NetBiochem/nucacids.html
2.	http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKinetics.html
3.	
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc19_cy07/previewExperimental Biochemistry
2.	https://swayam.gov.in/courses/4384-biochemistryBiochemistry

COURSE TITLE	**DIFFERENTIAL EQUATIONS AND STATISTICS**			**CREDITS**	**3**
COURSE CODE	**BMA01020**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	**To expose students to differential equations, numerical methods, and statistics with real-world applications.**				

Course Objective	1. To solve second-order differential equations and apply them to real-life problems. 2. To implement numerical methods to solve algebraic and transcendental equations. 3. To analyze data using statistical measures, correlation and hypothesis testing for small samples. 4. To compute and interpret the proportion of variance in ANOVA classifications. 5. To study reliability and use control charts for quality control.
Course Outcome	Upon completion of this course, the students will be able to 1. Evaluate second-order differential equations and use them to model real-world phenomena. 2. Apply numerical methods to solve algebraic and transcendental equations. 3. Analyze data using central tendency, dispersion, correlation, and hypothesis testing. 4. Design and interpret experiments using one-way ANOVA, two-way ANOVA, and three-way ANOVA. 5. Determine system reliability and monitor quality using hazard functions and control charts.

Prerequisites: Knowledge in fundamentals of mathematics at higher secondary level.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	3	1	1	-	-	-	-	-	2	2	2	-
CO-2	2	-	1	2	1	1	-	-	-	-	-	1	1	2	-
CO-3	2	-	1	2	1	1	-	-	-	-	-	1	1	2	-
CO-4	2	-	1	2	1	1	-	-	-	-	-	1	1	2	-
CO-5	2	-	1	2	1	1	-	-	-	-	-	1	1	2	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: DIFFERENTIAL EQUATIONS	**(6L+3T)**
Differential equations - Order - Degree -First order differential equations - Second order differential equations with constant coefficients – Particular integrals – $e^{ax}, cosax, sinax, e^{ax}cos\ bx, e^{ax}sinbx$ – Solving a system of simultaneous equations. **Suggested Readings:** Problems based on studying the growth or spread of certain diseases in the human body using second order differential equations.	**CO-1** **BTL-3**
MODULE 2: SOLUTION OF ALGEBRAIC EQUATIONS	**(6L+3T)**
Introduction to numerical analysis – The solution of algebraic and transcendental equations – Bisection method – Iteration method – Regula-Falsi method- Newton- Raphson method. **Suggested Readings:** Transcendental equations, System of Equations	**CO-2** **BTL-3**
MODULE 3: STATISTICS AND ERROR ESTIMATION	**(6L+3T)**

Measure of Central tendency – Mean, Median, Mode – Dispersion - Range - Standard Deviation - Correlation - Karl Pearson's coefficient of correlation – Introduction to Probability – Standard Error – Region of Rejection – Level of Significance – F -test – Chi - Square test. **Suggested Readings:** Statistical Inference & Testing, Sampling Distributions & Estimation.	**CO-3** **BTL-3**
MODULE 4: DESIGN OF EXPERIMENTS	**(6L+3T)**
Analysis of variance: one - way classification (CRD) – Two - way classification (RBD) – Three - way Classification (LSD). **Suggested Readings:** Comparison of treatment means, Interpretation of pairwise differences.	**CO-4** **BTL-3**
MODULE 5: RELIABILITY AND QUALITY CONTROL	**(6L+3T)**
Concepts of reliability - Hazard functions - Reliability of series and parallel systems - Control charts for measurements (X and R charts) – control charts for attributes (p, c and np charts). **Suggested Readings:** Life testing methods, accelerated life tests, preventive vs. corrective maintenance, reliability improvement techniques.	**CO-5** BTL-3

BOOKS	
1.	P. R. Vittal, "Statistics and Numerical Methods", Margham Publications, Chennai, 2012
2.	T. Veerarajan, "Probability, Statistics and Random Processes", Tata McGraw-Hill Education, New Delhi, 3rd Edi., 2012.
REFERENCE BOOKS	
1	P. Kandasamy and K. Thilagavathy, "Mathematics for B.Sc. Branch I -Vol. I, S. Chand and Company Ltd, New Delhi, 2014.
2	B. S. Grewal and J. S. Grewal, "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi, 2007.
3	S.C. Gupta & V.K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 12th Edi., 2020.
4	S. Arumugam, "Probability and Statistics", New Gamma Publishing House, Chennai, 2016.
E Resources for Reference	
1.	https://www.mathcentre.ac.uk/courses/mathematics/differential-equations/
2.	https://open.umn.edu/opentextbooks/textbooks/525
3.	https://www.cambridge.org/core/books/abs/ordinary-differential-equations/references/B5D30DD07EE9F7849EAA5C91A53033DF
MOOC	
1.	https://www.my-mooc.com/en/mooc/introduction-to-ordinary-differential-equations-3d15c208-5b00-40d5-a255-c2226d5eb6a3
2.	https://www.coursera.org/courses?query=differential%20equation

COURSE TITLE	ARTIFICIAL INTELLIGENCE IN CHEMISTRY			CREDITS	3
COURSE CODE	BCT01005	COURSE CATEGORY	AE	L-T-P-S	2-1-0-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance*	
15%	15%	10%	5%	5%	50%

Course Description	**This course introduces the fundamentals of Artificial Intelligence and Machine Learning with applications in chemistry. It emphasizes data-driven modeling, molecular property prediction, reaction analysis, and AI-assisted drug and materials design.**
Course Objective	1. To introduce the fundamental concepts of Artificial Intelligence, Machine Learning, and Data Science relevant to chemical applications. 2. To develop understanding of chemical data types, descriptors, and modelling approaches used in computational chemistry. 3. To familiarize students with AI tools and techniques used in molecular modelling, drug discovery, and chemical prediction tasks. 4. To enable students to apply AI methods for interpreting spectroscopic, analytical, and reaction data, enhancing problem-solving skills. 5. To create awareness of industrial applications, automation, ethical concerns, and future trends in AI-driven chemical research and innovation.
Course Outcome	Upon completion of this course, the students will be able to 1. Explain foundational AI and machine-learning concepts and their relevance to chemistry. 2. Handle and preprocess chemical datasets for modelling and predictive analysis. 3. Apply AI tools to predict molecular properties, chemical reactions, and drug-like behaviour. 4. Interpret spectroscopic and analytical data using AI-based methods for improved accuracy and efficiency. 5. Demonstrate understanding of industrial, environmental, and research applications of AI in chemistry, including ethical considerations and limitations.

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3

CO-1	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**3**	**2**	**-**	**1**	**3**	**3**	**2**	**3**
CO-2	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**3**	**2**	**-**	**1**	**3**	**3**	**2**	**3**
CO-3	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**3**	**2**	**-**	**1**	**3**	**3**	**2**	**3**
CO-4	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**3**	**2**	**-**	**1**	**3**	**3**	**2**	**3**
CO-5	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**3**	**2**	**-**	**1**	**3**	**3**	**2**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO AI AND DATA SCIENCE IN CHEMISTRY	**(9L)**
Basics of Artificial Intelligence, Machine Learning, and Deep Learning - Role of AI in scientific research and chemical industries - Types of chemical data: molecular, spectral, analytical, and experimental datasets - Data collection, cleaning, visualization, and preprocessing - Overview of cheminformatics and chemical databases (PubChem, ChemSpider).	**CO-1** **BTL-3**
MODULE 2: MACHINE LEARNING TECHNIQUES FOR CHEMICAL APPLICATIONS	**(9L)**
Supervised and unsupervised learning: regression, classification, clustering - Feature engineering for chemical data: descriptors, fingerprints - Model evaluation: accuracy, precision, recall, RMSE - Applications: predicting molecular properties, reaction outcomes, toxicity estimation.	**CO-2** **BTL-3**
MODULE 3: AI TOOLS FOR MOLECULAR MODELLING AND DRUG DESIGN	**(9L)**
AI in molecular structure prediction and optimization - QSAR/QSPR modelling concepts - Deep learning for drug discovery: neural networks, graph neural networks (GNNs) - Virtual screening, docking basics, and AI-assisted lead identification - Case studies from pharma and medicinal chemistry.	**CO-3** **BTL-3**
MODULE 4: AI IN SPECTROSCOPY, ANALYTICAL CHEMISTRY, AND CHEMICAL SYNTHESIS	**(9L)**
AI-assisted interpretation of IR, NMR, MS spectra - Pattern recognition in chromatographic data (HPLC/GC) - AI for reaction prediction, retrosynthesis, and mechanism exploration - Automation and robotics in chemical laboratories (smart labs).	**CO-4** **BTL-3**
MODULE 5: INDUSTRY APPLICATIONS, ETHICS, AND FUTURE TRENDS	**(9L)**
AI in materials chemistry: polymers, catalysts, batteries, nanomaterials - AI in environmental chemistry: pollution monitoring, waste management, green chemistry - Industrial chemical process optimization using AI - Ethical issues, data privacy, reliability, limitations - Emerging trends: generative AI for molecules, autonomous labs, digital chemistry.	**CO-5** BTL-3

BOOKS

1.	Shrikaant Kulkarni, Shashikant Bhandari, Dushyant Varshney & P. William, “Artificial Intelligence for Chemical Sciences: Concepts, Models, and Applications”, Apple Academic Press, 2025.
2.	Chen Qu & Hanchao Liu, “Machine Learning in Molecular Sciences”, Springer Cham, 2023.

REFERENCE BOOKS

1	N. P. Padhy, S. P. Simon & M. Senthil Kumar, “Artificial Intelligence”, Oxford University Press, 2025.
2	Kamal Kant Hiran, Ruchi Doshi, Ritesh Kumar Jain & Kamlesh Lakhwani, “Machine Learning”, BPB Publications (India), 2021.

3	
4	
E Resources for Reference	
1.	Artificial Intelligence - OUP India
2.	Machine Learning
3.	
MOOC	
1.	AI For Everyone | Coursera
2.	Top Free Courses - Learn Free Online

COURSE TITLE		**PERSONALITY DEVELOPMENT AND SOFT SKILLS**			**CREDITS**	**2**
COURSE CODE		**GLS51002**	**COURSE CATEGORY**	**HS**	**L - T – P – S**	**2 – 0 – 1 – 1**
Version	**1.0**	**Approval Details**			**LEARNING LEVEL**	**BTL – 4**

ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment	**Second Periodical Assessment**	**Weekly assignment/ lab record and viva as approved by the Department Examination Committee "DEC"**	**Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"**	**Attendance**	**Theory**	**Practical**
15 %	**15 %**	**10 %**	**5 %**	**5 %**	**25 %**	**25 %**

Course Description	**This course teaches the learners LSRW Skills which is needed in today's global workplace together with essential business vocabulary & grammar. It equips them to communicate effectively and at professional and social scenario which in turn makes them confident individuals. This course would help them to appear for Cambridge Certification and add value to their profile and validate their language proficiency.**
Course Objective	1. To acquire self-confidence by which the learner can improve upon their informative listening skills by an enhanced acquisition of the English language. 2. To provide an environment to Speak in English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.

	3. To equip the students to Read, comprehend and answer questions based on literary, scientific and technological texts. 4. To enhance the writing skills of the students via training in instructions, recommendations, checklists, process-description, letter-writing and report writing. 5. To equip the learners in analyzing and applying creative thinking skills and participate in brainstorming, mind-mapping, audiovisual activities and excel in employability skills.
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the ability to construct the grammatically correct sentences with accuracy and syntax structures. 2. Integrating various components of English Language and determining it through reading and listening. 3. Analyze and transcode data, construct different types of written essays, read complex passages and summarize ideas, create personal profiles in the form of a resume. 4. Organize and articulate ideas, concepts, and perceptions in a comprehensive manner in written business correspondence, and speaking in formal and informal situations. 5. Infer details about presentation skills and implementing it in various professional situations.

Prerequisites: Plus Two English-Intermediate Level

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-2	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-3	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-4	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-5	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 : ATTITUDE	**(6L)**
Grammar : 1. Countable and uncountable nouns 2. Asking questions 3. Expressing likes 4. Introducing reasons 4. Talking about large and small differences. 5. Expressing Results **Vocabulary:** 1. Recruitment Brochure: ability, certificate, course, etc., 2. Work, job, training course. 3. Job Responsibilities 4. Staff, Employee, member of Staff. 5. Phrases expressing enthusiasm 6. Adjective Forms **Writing :** 1. Report Writing – Staff Training Report 2. A Website entry 3. A short Email and an Email of a job application. **Reading :** Articles on Human Resources **Soft Skills and Employability Skills (LAB) : ATTITUDE :** The power of positive thinking – Positive self-talk – self-esteem and positive attitude who Am I ? Attitude in the workplace – Building a positive attitude – Testing your attitude – Adaptability	**CO-1** **BTL-2**
MODULE 2 : GOAL SETTING	**(6L)**
Grammar: 1. Infinitive or verb + ing, 2. Prepositions in phrases describing trends 3. Formal requests 4. First and Second conditionals. 5. Phrases followed by a Verb + ing.	**CO-2**

Vocabulary: 1. Word related to marketing (Launch, Play, Find out, Learn, Know, etc.,) 2. Revenue outcome 3. Adjective – noun collocations, 3. Last and latest **Writing:** 1. A marketing Report 2. Email giving information – making an enquiry – answering enquiries – correcting information – confirming terms 3 Memo Writing **Reading:** Articles on Marketing **Soft Skills and Employability Skills (LAB): GOAL SETTING:** What is goal ? - What are SMART goals? - How does SMART goal setting work? - Goals as commitment – Useful Guideline for goal setting – Trying personal and professional goals – Goals at the workplace – Cascading goals – Types of goals	**BTL-3**
MODULE 3 : TIME MANAGEMENT	**(6L)**
Grammar : 1. Prepositions in time phrases 2. Making recommendations 3. Phrases signaling parts of a presentation 4. Can and could **Vocabulary :** 1. Financial Terms 2. Rising finance 3. Noun Phrases connected with starting companies 4. Assets, collateral etc., **Writing :** Formal Letter : 1. A letter of enquiry 2. Proposal Writing **Reading :** Articles on Entrepreneurship **Soft Skills and Employability Skills (LAB): TIME MANAGEMENT** : What is time management? Prioritization – Time stressors – Time stealers – Time management - Eisenhower Matrix– Strategies for effective time management – productivity pyramid – The four Ds of time management	**CO-3** **BTL-3**
MODULE 4 : EMOTIONAL INTELLIGENCE	**(6L)**
Grammar : 1. Referencing 2. Using the Passives to express opinions and ideas. 3. Relative Clauses **Vocabulary :** 1. Collocations describing reasons for meetings, 2. Collocations with meeting 3. Crucial, priceless, etc., **Writing :** Arranging to travel; an email agreeing to a request and making suggestions – giving instructions – about a business trip – announcing a job opportunity. 2. A letter informing about a new service – complaint, **Reading :** Articles on Business abroad **Soft Skills and Employability Skills (LAB): EMOTIONAL INTELLIGENCE:** What is Emotional Intelligence? Enhancing your emotional self-awareness, - Emotional intelligence and change management – unfreezing the old, re-freezing the new – change and stress – emotional intelligence and crisis management.	**CO-4** **BTL-3**
MODULE 5 : LEADERSHIP	**(6L)**
Grammar : 1. Using the Definite Article 2. Expressing Causes 3. Reporting verbs and reported speech 4 Third Conditional (Imaginary) **Vocabulary :** 1. Verb – Noun collocations 2. Issues, impact, etc., 3. Way or method 4. Words and phrases expressing numbers. **Writing** : Mail arranging a meeting , introducing a company and asking for information – giving suggestions 2. A memo asking for suggestions 3. A proposal for out sourcing. **Reading :** Articles on Change in Business **Soft Skills and Employability Skills (LAB): LEADERSHIP :** Qualities of a leader – Leadership and assertiveness – problem –solving and decision-making – Approaches to problem – solving and decision-making – Brainstorming – Cause-and-effect analysis	**CO-5** **BTL-4**
TEXT BOOKS	

1	Brook-Hart, Guy (2019). Cambridge English Business Benchmark, Upper Intermediate. Cambridge University Press. India (Pages 208)
2.	Pillai, Sabina. Fernandez, Agna.(2018). Soft Skills and Employability Skills. Cambridge University Press. India. (Pages 208)
REFERENCE BOOKS	
1.	Murphy, Raymond (2019). Intermediate English Grammar. Cambridge University Press. India. (Pages 350)
2.	Barnes, D., (2020). Exploratory talk for learning in Mercer, N. and Hodgkinson, S. (eds) Exploring Talk in School. London: Sage Publications. (Pages 208)
3.	Dhanavel. S P (2018). English and Soft Skills. Orient BlackSwan. India. (Pages 136)
4.	Goldsmith, Marshall & M.S. Rao.(2020) Soft Skills: Enhancing Employability. Dreamtech Press. India (Pages 256)
E Books	
1	https://www.pdfdrive.com/basic-english-grammar-with-exercises-e12486779.html
2	http://dspace.vnbrims.org:13000/jspui/bitstream/123456789/4733/1/Leadership%20The%20Power%20of%20Emotional%20Intellegence.pdf
MOOC Courses	
1	https://www.edx.org/professional-certificate/ritx-communication-skills
2	https://www.coursera.org/specializations/people-and-soft-skills-for-professional-success

COURSE TITLE		**TAMIL**			**CREDITS**	**2**
COURSE CODE		**GLS51008**	**COURSE CATEGORY**	**HS**	**L - T – P – S**	**2 – 0 – 0 – 2**
Version	**0.0**	**Approval Details**			**LEARNING LEVEL**	**BTL- 3**

ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"**	**Attendance**	**End Semester Examination ESE**
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	This Tamil course improves Tamil language skills of the students' Tamil letters and Grammar are included. This course provides an opportunity not only to get interest in learning Tamil Language but also they can learn to converse easily.
Course Objective	1. By studying this course, students will be able to write and speak Tamil easily in any situation, daily life and daily conversations. 2. Develops language and interest in learning in students. 3. Facilitates students to create opportunities for themselves in the society. 4. Students also learn Tamil literature by developing interest in language department. 5. This lesson plan helps the students to learn about the culture by learning the Tamil language.
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the Letters and basic words of Tamil Language which are in daily use. 2. Develops the listening skills of Tamil language. 3. Utilize the letters and common words of the language for communication 4. Develop the conversational skills. 5.Demonstrate the skill of reading and writing.

Prerequisites: Plus Two -Intermediate Level

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-2	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-3	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-4	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-5	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

அலகு – 1: தமிழ் எழுத்துக்கள்	**(6L)**
தமிழ் எழுத்துகள் – ஓசைகள் - எண்கள் – வண்ணங்கள் – வடிவங்கள் - ஓர் எழுத்துச் சொற்கள் - பழங்கள் மற்றும் காய்கறிகள் – மலர்கள் – இயற்கை - மாதங்கள் சொற்கள் - பெயர்சொற்கள் – உரிச்சொற்கள் – வினைச்சொற்கள் – காலங்கள் - வாழ்த்துகள். வகுப்பறை செயல்முறைகள் : 1. வார்த்தைகளை வட்டமிடுதல்.	CO-1 BTL-2

2. விடுபட்ட எழுத்துகளை நிரப்புக. 3. வடிவங்களுக்கு வண்ணம் தீட்டுக.	
அலகு – 2: கேட்டல் மற்றும் உச்சரித்தல்	**(6L)**
உயிரெழுத்துகள், மெய்யெழுத்துகள் மற்றும் உயிர்மெய் எழுத்துகளை உச்சரித்தல் - சிறுகதைகள் வாசித்தல் – எதிர்ச்சொற்கள் - பொருள்தருக – வாக்கியத்தில் அமைத்து எழுதுதல் – ஒரு சொல்லில் விடையளித்தல். வகுப்பறை செயல்முறைகள் : 1. சொற்களைக் கேட்டு உச்சரிக்க செய்தல். 2. குழுவிவாதம் செய்தல். 3. கோடிட்ட இடங்களைச் சரியான சொற்களைக் கூறுதல்.	CO-2 BTL-2
அலகு -3 :எழுத்துப் பயிற்சி	**(6L)**
தமிழ் எழுத்துகளை எழுத கற்பித்தல் - உயிர் எழுத்துகள் - மெய் எழுத்துகள் - உயிர்மெய் எழுத்துகள் - ஆயுத எழுத்து – சார்பெழுத்துகள் – ஒற்றெழுத்துகள் - ஒரு சொல் - இருசொல் எழுதுதல் – ஒருவரி, இருவரி எழுதுதல். வகுப்பறை செயல்முறைகள்: 1. கோடிட்ட இடங்களை நிரப்புக. 2. சரியான எழுத்துகளை வட்டமிடுதல். 3. ஒருவரி சொற்களை எழுதுதல்.	CO-3 BTL-3
அலகு – 4: உரையாடல்கள் கற்பித்தல்	**(6 L)**
சிறு உரையாடல்கள் கற்பித்தல் – வாழ்த்துக்கள் - வங்கியில் பணம் செலுத்துதல் - சந்தையில் கடைகாரரிடம் உரையாடுதல், பொது இடங்களில் உரையாடுதல். வகுப்பறை செயல்முறைகள்: 1. குறு நாடகங்கள் நடித்து உரையாடல்கள் கற்பித்தல். 2. விண்ணப்ப படிவங்கள் பூர்த்தி செய்தல். 3. மின்னல் அட்டைகள் காண்பித்தல்.	CO-4 BTL-2
அலகு – 5: தமிழ் வாசிக்க மற்றும் எழுத கற்பித்தல்	**(6L)**
கடிதங்கள் வாசித்தல் மற்றும் எழுதுதல் – விண்ணப்ப கடிதம், வங்கிகணக்கு படிவங்கள், இரயில் முன்பதிவு விண்ணப்ப படிவம் பூர்த்திசெய்தல் – கவிதை வாசித்தல் – செய்திதாள் வாசித்தல். வகுப்பறை செயல் முறைகள்: 1. விண்ணப்ப படிவங்கள் பூர்த்திசெய்தல். 2. கவிதை வாசித்தல் போட்டிகள் 3. வகுப்பறை தேர்வுகள்	CO-5 BTL-3

TEXT BOOK

1.	Saidhai. P. Sundaramurthy (2018). Learn Tamil Through english. Manimekalai Prasuram. Chennai - 17.Pages 1 to 84
2.	Pulavar Kulanthai (2020). Students Basic Tamil. Manimekalai Prasuram. Chennai -17. Pages1 to 84

REFERENCE BOOKS

1.	Lenatamilvanan. (2017). Easy Tamil Grammar. Manimekalai Prasuram, Chennai -17, Pages 11 to 21.
2.	Tamilnadu Board - NCERT/CBSE-Books Class – 6th TO 9th (2021-2022)
E-REFERENCES	
1.	https://cbsetamil.com/cbse-tamil-book/,https://tamil.examsdaily.in/tnpsc-tamil-ilakkanam-material-pdf-download

COURSE TITLE		**HINDI**				**CREDITS**	**2**
COURSE CODE		**GLS51009**	**COURSE CATEGORY**	**HS**		**L - T – P – S**	**2 – 0 – 0 – 2**
VERSION	**0.0**	**APPROVAL DETAILS**				**BTL LEVEL**	**3**
ASSESSMENT SCHEME							
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC" etc.,**		**Attendance**	**End Semester Examination ESE**	
15%	**15%**	**10%**	**5%**		**5%**	**50%**	
Course Description	This course has been designed to develop the regional language skills of the students. The course includes Hindi language, literature, vocabulary and grammar. This course teaches students how to communicate accurately, appropriately and fluently in regional language.						
Course Objective	1. To provide an environment to Speak and write in Hindi at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate. 2. To equip the students to Read, comprehend and answer questions based on literary texts. 3. To help student to become sensitive to the requirements of the society and respond to it in a constructive way. 4. To provide an environment to students to read and appreciate the literature.						
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the ability to write the grammatically correct sentences with accuracy. 2. Integrating various components of Hindi Language and determining it through reading and listening. 3. Organize and articulate ideas, concepts, and perceptions in a comprehensive manner in						

	written correspondence, and speaking in formal and informal situations. 4. Infer details from after listening and reading and implement it in various professional situations. 5. Develop writing and speaking skills.

Prerequisites: Plus Two -Intermediate Level

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-2	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-3	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-4	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-5	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

मॉड्यूल 1: **हिंदी पत्र और लिपि**	**(6 L)**
हिंदी स्वर और व्यंजन अक्षर - आश्रित स्वर सीखें - व्यंजन और व्यंजन समूह - अनुस्वर व्यंजन - संज्ञा - सर्वनाम - क्रिया (भविष्य) - संभावित विशेषण - काल - हिंदी के त्वरित नियम - अभिवादन - 2 अक्षर शब्द बनाना, 3 अक्षर शब्द - हर दिन शब्दावली - संख्याएं - रंग - परिवार - वस्त्र - बगीचा - घर - फल और सब्जियां - प्रकृति **सुझाई गई गतिविधियां:** देशी वक्ताओं द्वारा स्वर और व्यंजन का उच्चारण सुनना स्वर और व्यंजन के वीडियो, 2 अक्षर और 3 अक्षर के शब्द, और प्रतिदिन प्रयोगार्थ शब्दावली	**CO-1** **BTL-2**
मॉड्यूल 2: **सुनने का कौशल**	**(6 L)**
स्वर और व्यंजन का उच्चारण सुनना - लघु कथाएँ सुनना - साक्षात्कार - भाषण - सामाजिक मुद्दों पर पॉड वार्ता - निर्धारित पाठों को सुनना: इकाई 1 सभ्यता का रहस्य, इकाई 2 - युवावों से - वार्तालापों को सुनना - जानकारी सुनना - सम्मेलनों के भाषण **सुझाई गई गतिविधियां**: सुनें और चुनें उम्मीदवार पाठ को सुनते हैं और तीन विकल्पों के साथ बहुविकल्पीय प्रश्न का उत्तर देते हैं। उम्मीदवार टीवी चैनलों में बातचीत - साक्षात्कार- अतिथि व्याख्यान, सम्मेलनों और कार्यशालाओं के दौरान विशेषज्ञों के भाषण सुनते हैं	**CO-2** **BTL-3**
मॉड्यूल 3: बोलने का कौशल	**(6 L)**

औपचारिक संवाद - अनौपचारिक संवाद - लिंग रूपों के साथ बोलना - संख्या - काल - परिवार, शहर, त्योहारों, शौक आदि जैसे सामान्य विषयों पर बोलना - पसंद और नापसंद व्यक्त करना - ज़रूरतें और संपत्ति - भूमिका निभाना। **सुझाई गई गतिविधियां:** प्रस्तुति – कार्यक्रमों का संचालन - भाषण देना	**CO-3** **BTL-3**
मॉड्यूल- 4 : पढ़ने का कौशल	**(6 L)**
नमूना पढ़ना - नकल पढ़ना - अक्षरों और शब्दों का सही उच्चारण करना - पढ़ने में प्रवाह - कहानियाँ पढ़ना- संपादकीय, समाचारपत्र के लेख पढ़ना। **सुझाई गई गतिविधियां** फ्लैशकार्ड का उपयोग - चार्ट - चित्रों की पहचान करना - शब्दों को पढ़ना	**CO-4** **BTL-3**
मॉड्यूल-5 लेखन कौशल	**(6 L)**
सामान्य पत्राचार - पत्र लेखन: छुट्टी लेने पत्र, बैंक खाता खोलना, पुस्तकें मंगवाने के लिए पत्र, शिकायत पत्र - संकेत विकास - ज्ञापन - नोटिस **सुझाई गई गतिविधियां:** निर्धारित पाठ्यपुस्तक के अनुसार अभ्यास पूरा करना	**CO-5** **BTL-3**

पाठ्य पुस्तक

1.	Sashtri. S.R.(2019). Hindi Shikshak, Dakshina Bharat Hindi Prachar Sabha, Chennai (Pages 137)

संदर्भ पुस्तकें

1.	Prathamatic Patya Pushthak. (2022), Dakshina Bharath Hindi Prachar Sabha, Chennai. (Pages 168)
2.	Madhyama Patya Pushthak. (2022) Dakshina Bharath Hindi prachar Sabha, Chennai (Pages 184)

ई-संदर्भ

1.	https://www.hindipod101.com/

COURSE TITLE	TELUGU			CREDITS	2
COURSE CODE	GLS51010	COURSE CATEGORY	HS	L - T – P – S	2 – 0 – 0 – 2
Version	0.0	Approval Details		BTL LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"etc.,	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course has been designed to meet students' current and future language and communication needs. It attempts to develop their proficiency in the four language skills and knowledge of grammar and vocabulary. This course teaches students how to communicate accurately, appropriately and fluently in professional and social situations.
Course Objectives	1. This course is aimed to teach the basic Telugu language speaking skills. 2. It will introduce basic skills of the Telugu Language: its alphabets, essential words and simple sentence construction methods. 3. The course intends to facilitate students in acquiring foundational skills of reading, writing and speaking Telugu along with synonyms to expand vocabulary.
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the basic skills of Letters and sounds in Telugu. 2. Develop the basic vocabulary for everyday's conversation. 3. Construct simple Telugu sentences with the simple words. 4. Utilize the words that have conjunct character, and can learn functional, everyday conversation**.** 5. Construct Simple sentences for delivering appropriate meaning.

Prerequisites: Plus Two Telugu-Intermediate Level

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-2	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-3	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-

CO-4	-	**3**	-	-	-	**1**	-	**1**	-	**1**	**1**	**2**	-	**1**	-
CO-5	-	**3**	-	-	-	**1**	-	**1**	-	**1**	**1**	**2**	-	**1**	-

1: Weakly related, 2: Moderately related and 3: Strongly related

భాగము 1 : వినడం, చెప్పడం మరియు రాయడం	**(6L)**
తెలుగు అచ్చులు & హల్లులు శబ్దాలు ధ్వనిచిత్రంతో పాటు తెలుగు హల్లుల సంయోగాల పరిచయం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసైన్‌మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	**CO-1** **BTL-2**
భాగము 2 : పేర్ల పదాలకు, సంఖ్యలకు, మరియు వాటి గుణాల పరిచయం	**(6L)**
తెలుగు నామవాచకం పరిచయం తెలుగు సర్వనామం & దాని విషయం సంఖ్యలు దాని పరిచయం & తెలుగు విశేషణాలు పరిచయం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసైన్‌మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	**CO-2** **BTL-3**
భాగము 3 : పదాలను విడదీసి వాక్యాలను రాయడం	**(6L)**
తెలుగు పూర్వ పదాలు – సంయోగాలు మరియు దాని ఉపయోగం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసైన్‌మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	**CO-3** **BTL-3**
భాగము 4 : పనులు, సమయం, క్రియ మరియు కాల వ్యవధుల పరిచయం	**(6L)**
వివిధ క్రియల యొక్క క్రియ & సమయం / కాల సంయోగాలనికి పరిచయం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసైన్‌మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	**CO-4** **BTL-3**
భాగము 5 : తెలుగు చదవడం, రాయడం మరియు ప్రశ్నించడం	**(6L)**
తెలుగులో సరళమైన వాక్యాలను రూపొందించడం (ప్రాథమిక వాక్య నిర్మాణ నియామాలు) తెలుగులో ప్రతీకూల వాక్యాలును రూపొందించడం తెలుగు బోధన అభ్యాస ప్రక్రియలో ప్రశ్నార్థకవాక్యాలువాక్యాలను రూపొందించడం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసైన్‌మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	**CO-5** **BTL-3**

TEXT BOOK

1.	Telugu Akademy. (2018). Sampradaya Telugu Vyakaranalu. Telugu Akademy. Vijayawada, Andhra Pradesh. India.
2.	Raghavendra. A. (2019). Telugu Vyakaranam. Prajasakti Book House. Tadepalli.

REFERENCE BOOKS

1.	Ramarao, Chekuri. (2019). A Reference Grammar of Modern Telugu. Emesco Books. Hyderabad
2.	Vemuri, V. Rao. (2020). Learn Telugu with Its Grammar, Eco Foundation, Vijayawada.
E-References	
1	https://sarkarihelp.com/telugu-grammar-pdf-download/

COURSE TITLE	**ELEMENTS AND FUNCTIONAL GROUP CHEMISTRY**			**CREDITS**	**4**
COURSE CODE	**BCT01006**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	**This course introduces the chemical properties and reactivity of S, P, and D block elements and explores the structure and behavior of key organic functional groups such as ethers, thioethers, epoxides, aldehydes, ketones, and carboxylic acids with their derivatives. It provides foundational understanding of both inorganic element chemistry and organic transformations relevant to higher-level studies.**				
Course Objective	This course aims to provide a comprehensive knowledge on 1. Properties of s-block elements 2. Properties of p-block elements 3. Transition elements with reference to periodic properties and group study of transition metals. 4. The organic chemistry of ethers, aldehydes and ketones. 5. The organic chemistry of carboxylic acids.				

Course Outcome	Upon completion of this course, the students will be able to 1. discuss the periodic properties of s block elements. 2. Understand the properties of p- block elements. 3. Explain nuclear chemistry concepts and assess methods of nuclear waste management. 4. Investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions. 5. Discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compounds including named organic reactions. Discuss the chemistry and named reactions related to carboxylic acids and their derivatives; discuss chemistry of active methylene compounds, halogen substituted acids and hydroxyl acids.

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: CHEMISTRY OF S AND P-BLOCK ELEMENTS	**(9L+3T)**
Hydrogen: Position of hydrogen in the periodic table. Alkalimetals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, Na_2CO_3, KBr, $KClO_3$ alkaline earth metals. Anomalous behaviour of Be. **Chemistry of p-Block Elements (Group 13 &14):** Preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al. Comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Percarbonates, per mono carbonates and per di carbonates.	**CO-1** **BTL-3**
MODULE 2: CHEMISTRY OF P-BLOCK ELEMENTS (GROUP15-18)	**(9L+3T)**
General characteristics of elements of Group 15; chemistry of H_2N-NH_2, NH_2OH, NH_3 and HNO_3. Chemistry of PH_3, PCl_3, PCl_5, $POCl_3$, P_2O_5 and oxy acids of phosphorous (H_3PO_3 and H_3PO_4). General properties of elements of group 16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids). Chemistry of Halogens: General characteristics of halogen with reference to electro- negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids ($HClO_4$). Inter-halogen compounds (ICl,ClF_3,BrF_5 and IF_7), pseudo halogens [$(CN)_2$ and $(SCN)_2$] and basic nature of Iodine. Noble gases: Position in the periodic table. Preparation, properties and structure of XeF_2, XeF_4, XeF_6 and $XeOF_4$; uses of noble gases – clathrate compounds.	**CO-2** **BTL-3**

MODULE 3: GENERAL CHARACTERISTICS OF D-BLOCK ELEMENTS	(9L+3T)
Transition Elements- Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non-transition elements– comparison of II and III transition series with I transition series. Group study of Titanium, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel and Zinc groups.	**CO-3** **BTL-3**
MODULE 4: ETHERS, THIOETHERS AND EPOXIDES, ALDEHYDES AND KETONES	**(9L+3T)**
Ethers, Thioethers and Epoxides: Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH4, Thioethers-nomenclature, structure, preparation, properties and uses. Aldehydes and Ketones: Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalyzed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer- Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein – Pondorf Verley reduction, reduction with LiAlH4and NaBH4. Addition reactions of unsaturated carbonyl compounds: Michael addition.	**CO-4** **BTL-3**
MODULE 5: CARBOXYLIC ACIDS AND ITS DERIVATIVES	**(9L+3T)**
Carboxylic Acids: Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. HVZ reaction, Claisen ester condensation, Bouveault Blanc reduction, decarboxylation, Hunsdiecker reaction. Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxyl acids and unsaturated acids. **Carboxylic acid Derivatives:** Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. Schottan- Baumann reaction. Claisen condensation, Dieckmann and Reformatskyreactions,HofmannbromamidedegradationandCurtiusrearrangement. **Active methylene compounds:** Keto– enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate **Halogen substituted acids –** nomenclature; preparation by direct halogenation, iodination from unsaturated acids, alkyl malonic acids **Hydroxy acids** – nomenclature; preparation from halo, amino, aldehydic and ketonic acids, ethylene glycol, aldol acetaldehyde; reactions–action of heat on α, β and γ hydroxy acids.	**CO-5** BTL-3

TEXT BOOKS	
1.	M. K. Jain, S. C. Sharma, "Modern Organic Chemistry", Vishal Publishing, 4th reprint, 2003.
2.	B.R. Puri, L. R. Sharma and K.C. Kalia, "Principles of Inorganic Chemistry", Milestone Publishers and Distributors, New Delhi, 30th edition,2009.
REFERENCE BOOKS	
1	A. Carey Francis, "Organic Chemistry", Tata McGraw- Hill Education Pvt., Ltd., New Delhi, seventh

	edition, 2009.
2	J.A. Joule, and G.F. Smith, "Heterocyclic Chemistry", Wiley,5th Edition,2010.
3	P.L. Soni, and H.M. Chawla, "Text Book of Organic Chemistry", New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007.
4	J.D. Lee, "Concise Inorganic Chemistry", Blackwell Science, fifth edition, 2005.
E Resources for Reference	
1.	www.epgpathshala.nic.in
2.	www.nptel.ac.in
3.	http:/swayam.gov.in
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc26_cy14/preview
2.	https://onlinecourses.swayam2.ac.in/cec26_cy01/preview

COURSE TITLE	**QUALITATIVE INORGANIC ANALYSIS**			**CREDITS**	**2**
COURSE CODE	**BCT01402**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-4-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-4**

ASSESSMENT SCHEME

CIA					**ESE**
Experimental	**Calculation**	**Result**	**Viva**	**Record**	
20%	**10%**	**10%**	**5%**	**5%**	**50%**

Course Description	**Qualitative Inorganic Analysis involves the systematic identification of cations and anions through classical wet-chemical techniques. The course trains students in scheme-based analysis, observation skills, and logical interpretation of inorganic salts.**
Course Objective	1. To develop the skill on systematic analysis of mixture of inorganic salts. 2. To study the principles/equation of the experiment.

Course Outcome	Upon completion of this course, the students will be able to 1. acquire knowledge on the systematic analysis of simple salts. 2. identify the cations and anions in the unknown substance. 3. identify the cations and anions in the soil and water and to test the quality of water. 4. assess the role of common ion effect and solubility product.

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-2	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-3	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-4	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-5	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: SEMI-MICRO QUALITATIVE ANALYSIS (60P)

1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, chloride, bromide, iodide, nitrate 2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate. 3. Elimination of interfering acid radicals and identifying the group of basic radicals 4. Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, iron, aluminium, arsenic, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium. 5. Analysis of a mixture I to VIII containing two cations and two anions – of which one is interfering type.	**CO-1,2** **BTL-3**

BOOKS

1.	V. Venkateswaran, R.Veera swamy and A.R. Kulandivelu, "Basic Principles of Practical Chemistry", Sultan Chand & Sons, New Delhi, 2nd ed., 1997.
2.	G. Charlot, "Qualitative Inorganic Analysis", Thomas Press, 2007.

REFERENCE BOOKS

1	Huda S. Alhasan, Nadiyah Alahmadi, "Principles of Qualitative Inorganic Analysis: Precipitation, Separation and Identification of Cations", Bentham Science, 2021.
2	Svehla and Sivasankar, "Vogel's Qualitative Inorganic Analysis", Pearson Education India, 7th Edi., 2012.

E Resources for Reference

1.	https://www.vlab.co.in/broad-area-chemical-sciences
2.	benthambooks.com/ebook-files/sample-files/9789811492631-sample.pdf
3.	

MOOC

1.	IIT-JAM - Complete Course on Qualitative Inorganic Analysis by Unacademy
2.	A Detailed Course of Qualitative Chemical Analysis of Inorganic Substances, with Explanatory Notes | Nature

COURSE TITLE	MECHANICS AND THERMAL PHYSICS			CREDITS	4
COURSE CODE	BPH01002	COURSE CATEGORY	PC	L-T-P-S	2-1-2-0
VERSION	0.0	APPROVAL DETAILS		LEARNING LEVEL	BTL – 3

ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / Lab records as approved by the Department as approved by the Department Examination Committee 'DEC"	Attendance	ESE
15%	15%	10%	5%	5%	Theory 25% Practical 25%

Course Description	**The course is designed to apply the concepts of physics including linear, periodic and rotational motions, engineering fluid mechanics, heat transfer in multiple systems, thermodynamics, and the strength of materials which are the most important and fundamental need for a chemistry student.**
Course Objectives	1. To distinguish and explain the various types of motion and forces acting on a system 2. To describe the motion on curved surface and analyze the equilibrium conditions on simple machines 3. To apply the concepts of fluid mechanics in hydraulic system, capillary action and lubrication 4. To derive the heat transfer in series and parallel flow and utilize the laws of thermodynamics in engine efficiency 5. To measure the strength of elastic materials and determine the twisting couple on thin cylindrical wire
Course Outcomes	Upon completion of this course, the students will be able to 1. Discuss the linear and periodic motion in one dimension 2. Explain the motion on curved surface and compile the working of simple machines 3. Apply the concepts of fluid mechanics in hydraulic system and assess the viscosity in flow rate 4. Identify the modes of heat transfer and explain the laws of thermodynamics 5. Evaluate the stress-strain diagram and define twisting couple

Prerequisites: Knowledge in fundamental level of Physics at school level.

CO, PO AND PSO MAPPING

COs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3

CO1	**3**	**-**	**1**	**2**	**3**	**1**	**2**	**-**	**1**	**-**	**-**	**3**	**3**	**2**	**1**
CO2	**3**	**-**	**1**	**2**	**3**	**1**	**2**	**-**	**1**	**-**	**-**	**3**	**3**	**2**	**1**
CO3	**3**	**-**	**1**	**2**	**3**	**1**	**2**	**-**	**1**	**-**	**-**	**3**	**3**	**2**	**1**
CO4	**3**	**-**	**1**	**2**	**3**	**1**	**2**	**-**	**1**	**-**	**-**	**3**	**3**	**2**	**1**
CO5	**3**	**-**	**1**	**2**	**3**	**1**	**2**	**-**	**1**	**-**	**-**	**3**	**3**	**2**	**1**

1 - Weakly Correlated, 2 - Moderately Correlated and 3 - Strongly Correlated

Module 1: MECHANICS	**(9L+6P)**
Motion in one dimension – Velocity and acceleration - Newton's laws of motion – Types of conservative and non-conservative forces –Inertia. Periodic motion – Period of simple pendulum – Simple harmonic motion – Damped oscillator. **Practical component:** Determining the time period of simple pendulum oscillation.	**CO-1** **BTL-3**
Module 2: ROTATIONAL DYNAMICS	**(9L+6P)**
Angular momentum – Conservation of angular momentum – Circular motion – Centripetal force – Centrifugal force – Motion on curved surface (Banked curve). Torque – Conditions for equilibrium – Simple machine (lever, wheel & axle, pulley) - Centre of mass (point mass and continuous mass distribution). **Practical component:** Graphical relation for angular velocity and angular momentum for uniform and non-uniform circular motion.	**CO-2** **BTL-3**
Module 3: FLUIDS	**(9L+6P)**
Synclastic and anticlastic surface – Pressure – Pascal's principle – Hydraulic brake system – Poiseulle's law – Turbulence and streamline flow – Reynold's number - Surface tension – Capillary action – Application to spherical and cylindrical drops and bubbles. Viscosity – Rate flow of liquid in a capillary tube – Determination of coefficient of viscosity of a liquid – Variations of viscosity of a liquid with temperature lubrication. **Practical component:** Determination of viscosity of fluid using Poiseuille's method.	**CO-3** **BTL-3**
Module 4: THERMAL PHYSICS	**(9L+6P)**
Heat – Modes of heat transfer – Series and Parallel flow of heat – Thermal conductivity – Thermal coefficient of bad conductors by Lee's disc method. First law of thermodynamics – Isothermal and adiabatic changes – Work done in isothermal and adiabatic changes – PV diagrams – Second law of thermodynamics – Heat engine – Expression for efficiency of Carnot's cycle – Carnot's theorem – Third law of thermodynamics. **Practical component:** Determination of thermal coefficient of bad conductor by Lee's disc method.	**CO-4** **BTL-3**
Module 5: ELASTICITY	**(9L+6P)**

Elasticity – Hooke's law – Stress-strain diagram – Elastic moduli – Relation between elastic constants – Poisson's Ratio – Expression for Poisson's ratio in terms of elastic constants. Couple – Moment of couple – Twisting couple on a cylindrical wire – Torsional pendulum – Determination of Rigidity modulus and moment of inertia - q, η and σ by Searles method (Qualitative). **Practical component:** Determination of rigidity modulus of thin wire.	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill Publications, 7th Edition, US, 2017.
2.	Rajendran V. "Engineering Physics", Tata McGraw Hill Publications, 3rd Edition, US, 2017.
REFERENCE BOOKS	
1.	Verma H. C. "Concepts of Physics", Bharti Bhavan Publisher, New Delhi, India, 2018.
2.	Halliday, Resnick and Walker, "Fundamental of Physics Extended", Wiley & Sons, 12th Edition, US, 2021.
E BOOKS	
1.	file:///C:/Users/Admin/Downloads/The%20Basics%20of%20Physics%20(Basics%20of%20the%20Hard%20Sciences)%20(%20PDFDrive%20).pdf
2.	file:///C:/Users/Admin/Downloads/Fluid%20and%20Thermodynamics_%20Volume%201_%20Basic%20Fluid%20Mechanics%20(%20PDFDrive%20).pdf
3.	http://ronney.usc.edu/AME101/AME101-LectureNotes.pdf
MOOC	
1.	http://nptel.ac.in/courses/115106061
2.	http://nptel.ac.in/courses/117101054/12

COURSE TITLE		**PUBLIC SPEAKING**				**CREDITS**	**1**
COURSE CODE		**GLS51005**	**COURSE CATEGORY**	**HS**	**L - T – P – S**		**0 – 0 – 2 –0**
Version	**0.0**	**Approval Details**			**LEARNING LEVEL**		**BTL – 4**
ASSESSMENT SCHEME							
CIA						**ESE**	
First Periodical Assessment	**Second Periodical Assessment**	**Practical**	**Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"**	**Attendance**		**Theory**	**Practical**

15 %	15 %	10 %	5 %	5 %	25%	25%

Course Description	**This course is an introduction to speech communication that emphasises the practical skill of public speaking, including techniques to lessen speaker anxiety and the use of visual aids to enhance speaker presentations. Civility and ethical speech-making are the foundations of this course. Its goal is to prepare students for success in typical public speaking situations and to provide them with the basic principles of organisation and research needed for effective speeches.**
Course Objective	By the end of this course, students will be able to: 1. Develop the ability to critically evaluate speeches by assessing both verbal and non-verbal elements to effectively analyse their overall effectiveness. 2. Enhance audience analysis skills to understand the preferences, needs, and characteristics of the target audience and design speeches that align with their expectations and interests. 3. Acquire the capability to organise speeches in a manner that achieves specific objectives, such as providing informative content, persuasive arguments, or fulfilling the unique requirements of special occasions. 4. Master the application of presentation aids to complement and amplify the impact of speeches, utilising visual, auditory, or other supportive tools to enhance engagement and comprehension. 5. Develop proficient research skills by critically analysing and interpreting diverse and relevant sources of information on a wide range of topics to bolster the credibility and depth of the speeches.
Course Outcome	Upon completion of this course, the students will be able to 1. Evaluate speeches based on a variety of verbal and non-verbal criteria. 2. Analyse the audience and design speeches to reflect the analysis. 3. Organise the speech that informs, persuades, or fulfils the needs of a special occasion. 4. Apply the presentation aids to enhance the speech. 5. Analyse meaningful research on a variety of topics.

Prerequisites: Plus Two English-Intermediate Level

CO, PO AND PSO MAPPING

CO	PO - 1	PO- 2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO- 8	PO- 9	PO - 10	PO- 11	PO- 12	PSO- 1	PSO- 2	PSO- 3
CO-1	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-2	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-3	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-4	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-5	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 : INTRODUCTION TO PUBLIC SPEAKING AND SPEECH EVALUATION	**(3L+3P)**
Introduction – What is public speaking? – Different kinds of speeches – Mastery of language – Criteria for Evaluating Speeches-Awareness to strategies – Evaluating Verbal Criteria– Adapting Speech to Audience and Context	**CO-1** **BTL-2**

Speaking Skills (Activities): Self-Introduction- Speak for 60 seconds	
MODULE 2 : ANALYZING THE AUDIENCE AND DESIGNING SPEECHES	**(3L+3P)**
Public Speaking and Audience Analysis- Acquire knowledge – Skill in real life presentation – Techniques for Conducting Audience Analysis– Adapting Speech Content- Visual aids – Ethical Considerations in Audience Analysis and Speech Design **Speaking Skills (Activities):** Group Discussions and Team Presentation-Role Plays -Monologues- Recitations	**CO-2** **BTL-3**
MODULE 3 : ART OF SPEAKING	**(3L+3P)**
Organizing Speeches for Information, Persuasion, and Special Occasions- Art of speech – Organizational Structures for Informative Speeches– Adapting Speech Organization to Special Occasions - Visual and Verbal Techniques for Speech Organization- To have self-confidence – Humour – Anecdotes – Personal experiences – knowledge on current events **Speaking Skills (Activities)**: Group Debates - Impromptu Speaking	**CO-3** **BTL-3**
MODULE 4 : APPLYING PRESENTATION AIDS TO ENHANCE SPEECHES	**(3L+3P)**
Public Speaking and Presentation Aids- Types of Presentation Aids- Designing and Creating Effective Visual Aids- Incorporating Audio and Physical Aids-Delivering method – Involvement – Organization – Planning and designing meticulously- Presenting with Presentation Aids **Speaking Skills (Activities)**: Master of Ceremony-Group Activities and Open Discussion	**CO-4** **BTL-3**
MODULE 5 : DELIVERY AND EXECUTION	**(3L+3P)**
Preparation – Purpose of the Speech - Selecting the subject – Making an outline – Research Analysis Methods for Informative Speeches -Gathering materials – Critical Thinking and Research Ethics– Time Management – Rehearsing **Speaking Skills (Activities)**: On the spot topic speech for 5 minutes-Mock Interviews – Panel sessions	**CO-5** **BTL-4**

TEXT BOOKS	
1.	Carnegie, Dale and Esenwein, J. Berg. The Art Of Public Speaking. Rupa Publications India, 2018
REFERENCE BOOKS	
1.	Peale, Norman Vincent. The Power of Positive Thinking, Fingerprint Publishing, 2017
2.	Carnegie, Dale. The Art of Public Speaking, Mittal Books Publishing House, 2015
E BOOKS	
1.	https://www.managementhelp.org/public-speaking
2.	https://gtu.ge/Agro-Lib/successful-public-speaking.pdf
MOOC	
1.	https://www.coursera.org/learn/public-speaking
2.	https://onlinecourses.nptel.ac.in/noc22_hs134/preview

COURSE TITLE		FRENCH			CREDITS	2
COURSE CODE		GLS51011	COURSE CATEGORY	HS	L - T – P - S	2 – 0 – 0 - 2
Version	0.0	Approval Details			LEARNING LEVEL	BTL – 3

ASSESSMENT SCHEME					
CIA					End Semester Examination (ESE) Theory
First Periodical Assessment	Second Periodical Assessment	Weekly assignment/ lab record and viva as approved by the Department Examination Committee "DEC"	Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"	Attendance	
15 %	15 %	10 %	5 %	5 %	50%

Course Description	Introduces students to the culture and language of the French-speaking world. Students develop an ability to communicate in real-life situations by acquiring reading, writing, listening, and speaking skills. The elementary courses prepare students to communicate successfully in some common basic social situations using the four language skills—listening, speaking, reading, and writing—within appropriate cultural contexts. The student will also acquire an understanding of cross-cultural awareness.
Course Objective	1. To discover basic elements of the language, such as the different phonemes, the alphabet and its pronunciation 2. To discover the foundation of the language such as conjugations, auxiliaries, numbers, etc. 3. To learn how to form simple sentences about personal topics such as one's family 4.To start interacting with others by asking and answering simple questions 5. Understand your learning style and be able to check your own progress.
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate advanced proficiency in spoken and written French. 2. Demonstrate the ability to read critically, interpret analytically, speak persuasively, and write coherently about visual and literary texts produced in the French-speaking world. 3. Demonstrate familiarity with methodological approaches in the study of literary and cultural

	texts, such as close reading, socio-historical contextualization, and literary and cultural theory. 4. Demonstrate knowledge of literary and cultural traditions, such as major movements, writers, and works of the French-speaking world, focusing on at least one and ideally multiple traditions: European, African, Caribbean, Asian, North American, and other Francophone cultures. 5. Demonstrate the skills necessary for scholarly research and writing in the Humanities.

Prerequisites: Intermediate Level

CO, PO AND PSO MAPPING

CO	PO - 1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-2	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-3	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-4	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-5	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE – 1: INTRODUCTION FRANÇAISE	**(6L)**
1.1 Introduction au cours de français - 1hr 1.2 La France et ses clichés - 2hr 1.3 Première rencontre (saluer, prendre congé, parler de son humeur) - 1hr 1.4 Qui es-tu? (se présenter, les chiffres 1-20, être et avoir) - 2hrs 1.5 Activité fiche d'identité	**CO-1** **BTL-2**
MODULE – 2: LE MONDE QUI M'ENTOURE	**(6L)**
2.1 Quel temps fait-il? (la météo, les chiffres 20-49) - 1hr 2.2 Mes couleurs préférées (la possession, le genre des articles) - 2hrs 2.3 Introduction à la Révolution Française - 2hrs 2.4 Me repérer dans le temps 1: la date (mois, jours, années) - 2hr 2.5 Me repérer dans le temps 2: l'heure (chiffres 49-60) - 2hrs	**CO-2** **BTL-3**
MODULE – 3: MES GOÛTS	**(6L)**
3.1 La nourriture en France - 2hrs	**CO-3**

3.2 Exprimer ses goûts (verbes du 1er groupe, négation verbale) - 2hrs 3.3 Manger et boire en France - 1hr 3.4 Ma famille extraordinaire - 2hrs 3.5 Activité “qui est qui?” - 2hrs	**BTL-3**
MODULE – 4: MON QUARTIER EST UN MONDE	**(6L)**
4.1 Mon quartier idéal (lieux de la ville, prépositions de lieu, habiter et vivre) - 2hrs 4.2 C’est par où? (verbe aller, les directions, l’impératif, donner des indications) - 2hrs 4.3 Activité “où vont-ils?” trouver l’itinéraire - 1hr 4.4 On y va comment? (les transports, conduire et prendre, la préposition en/à) - 2hr 4.5 Montmartre, un quartier pas comme les autres. 2hrs	**CO-4** **BTL-3**
MODULE – 5: JOUR APRES JOUR	**(6L)**
5.1 Une journée ordinaire (verbes pronominaux, routine, emploi du temps) - 2hrs 5.2 Mes petites habitudes (la fréquence définie et indéfinie) - 1hr 5.3 Une carte postale de vacances - 2hrs 5.4 La provenance et la destination (prépositions in, from, to, le genre des pays) - 1hr 5.5 Mes vacances idéales (adjectifs démonstratifs) -2hr	**CO-5** **BTL-4**
TEXT BOOKS	
	1.Alter Ego 1 Cahier d’Activités, Annie BERTHET & Co, Hachette 2006 2. Version Originale Cahier d’Exercices, Monique DENYER & Co, ED. Maison des Langues, 2011
REFERENCE BOOKS	
1.	Alter Ego 1
2.	Version Originale 1
E Books	
	1. www.lepointdufle.net 2. https://www.podcastfrancaisfacile.com/ 3. https://didierfle.com/ 4. https://lebaobabbleu.com/ 5. https://leszexpertsfle.com/ 6. https://www.ressourcesfle.fr/

	7. https://lecafedufle.fr/

COURSE TITLE		GERMAN			CREDITS	2
COURSE CODE		GLS51012	COURSE CATEGORY	HS	L - T – P - S	2 – 0 – 0 - 2
Version	0.0	Approval Details			LEARNING LEVEL	BTL – 3

ASSESSMENT SCHEME

CIA					End Semester Examination (ESE) Theory
First Periodical Assessment	Second Periodical Assessment	Weekly assignment/ lab record and viva as approved by the Department Examination Committee "DEC"	Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"	Attendance	
15 %	15 %	10 %	5 %	5 %	50%

Course Description	The students shall understand the basic German Language concepts and cultural difference. They can manage to understand and communicate in German when they travel to Germany.
Course Objective	1) To equip the students with a basic daily communication in German. 2) To enable the students to learn the spoken German required to communicate with native speakers 3) To help the students to understand the 4 different modules (Horen, Schreiben, Sprechen and Lesen) which is required to clear the A1 first level international certificate exam. 4) The understand the concepts which is required for pursuing their PG or Job in Germany.
Course Outcome	Upon completion of this course, the students will be able to 1. Recall and recognize the facts and use familiar, everyday expressions, create very simple sentences, which relate to the satisfying of concrete needs. 2. Build a knowledge on understanding the texts and trying to communicate in a simple manner provided the person they are speaking to speaks slowly and clearly and is willing to help.

	3. Apply and recalling the basic German Vocabulary, Verb conjugations with pronouns, expressions and connecting the learned facts to communicate in simple German sentences 4. Applying the above learned facts and trying to create own sentences, E-mails etc. as per the basic level achieved 5. Analyzing the native speaker and apply the knowledge (at basic level) in writing and speaking parts.

Prerequisites: Intermediate Level

CO, PO AND PSO MAPPING

CO	PO - 1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-2	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-3	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-4	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-5	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: SUPER	**(6L)**
Jemanden vorstellen - Eine Hitliste internationaler Wörter schreiben - Nach dem Namen und der Herkunft fragen - Eine kursliste schreiben **Grammatik:** regelmäßge verben – möchten,sprechen,sein - Personalpronomen – ich,du,er,sie. - Definiter Artikel im nominative der, die, das - W - Rragen, Ja/Nein Fragen - Präpositionen – aus, in	**CO-1** **BTL-2**
MODULE 2 : MENSCHEN	**(6L)**
Jemanden nach dem Befinden fragen - Sich verabschieden - **Interview:** Informationen über die Familie erfragen und darüber berichten - Über seine Freunde und die Freunde anderer schreiben und sprechen **Grammatik:** Indefiniter Artikel – ein/eine - Negativartikel – kein/keine... Possessiveartikel – mein, dein, sein..	**CO-2** **BTL-3**
MODULE 3 : ESSEN UND TRINKEN	**(6L)**
Lebensmittel vergliechen - Lieblingfarbe und Lebensmittel zuordnen - Umfrage: mein Lieblingsfrühstück - Eine Einkaufsliste für ein Lieblingsessen schreiben **Grammatik:** Verb Konjugation – sein,haben - Imperative! Verbposition im Satz - W -Rragen, Ja/Nein Fragen	**CO-3** **BTL-3**
MODULE 4 : MEIN LEBEN	**(6L)**

Sich über Leben, Beruf, Herkunft, etc..austauschen - Eine Visitenkarte schreiben **Interview:** sich über den Tagensablauf austauchen - Die zahlen bis 100 **Grammatik:** Trennbaren verbena - "man" und "negation nicht" benutzen - Akkusativ(definite/indefinite/negative Artikel) - Präpositionen – um, als, für,bei	**CO-4** **BTL-3**
MODULE 5 : FREIZEIT	**(6L)**
Ein kursposter mit Hobbys schreiben - Welche Hobbys habe ich,welche nicht - Notieren und sprechen – Was man selbst und die Familie am - Wochenende gerne macht- Über seinen Sonntag schreiben **Grammatik:** Modalverben - Präpositionen – in,am	**CO-5** **BTL-4**

TEXT BOOKS	
1	Rolf Bruseke , Starten Wir! (A1) ,Hueber Verlag,2018
REFERENCE BOOKS	
1.	Stefanie Dengler, "Netzwerk neu A1.1 [Kurs und Übungsbuch]" ,Klett, 2015
2.	Harmut Aufderstrasse,Heiko Bock, "Themen 1 aktuell kursbuch",Hueber,2003
E Books	
1.	https://www.learn-german-online.net/en/learning-german-resources/free-german-lessons-a1.htm

COURSE TITLE		**SPANISH**			**CREDITS**	**2**
COURSE CODE		**GLS51013**	**COURSE CATEGORY**	**HS**	**L-T-P-S**	**2-0-0-2**
Version	**0.0**	**Approval Details**			**LEARNING LEVEL**	**BTL- 3**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments / Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"**	**Attendance**	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	This Spanish language course has been programmed to meet the grammatical and conversation needs of the student. Its content is very comprehensive and will also assist in the professional and personal language requirement of the student

Course Objective	1. To facilitate the student in reaching out to international clients across the globe. 2. To make an immediate connect by speaking to the prospective client/ company in their native language. 3. To improve the overall personality of the student thereby making him/her more confident to communicate with global clients. 4. To provide survival skills to students relocating In countries where Spanish is spoken. This includes USA, all the Latin American countries and Spain.
Course Outcome	1. Develop an understanding in spoken Spanish and construction of basic sentences. 2. Creating conversations & oral understanding. 3. Make the learners to decode a message and to give a suitable reply in the same manner. 4. Build an overall idea on the perceptions, phrases, and other vocabulary. 5. Evaluate and understanding of the language and also its culture, music, food and other aspects of the language.

Prerequisites: Plus Two -Intermediate Level

CO, PO AND PSO MAPPING

CO	PO - 1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	**3**	-	-	-	**1**	-	**1**	-	**1**	**1**	**2**	-	1	-
CO-2	-	**3**	-	-	-	**1**	-	**1**	-	**1**	**1**	**2**	-	**1**	-
CO-3	-	**3**	-	-	-	**1**	-	**1**	-	**1**	**1**	**2**	-	**1**	-
CO-4	-	**3**	-	-	-	**1**	-	**1**	-	**1**	**1**	**2**	-	**1**	-
CO-5	-	**3**	-	-	-	**1**	-	**1**	-	**1**	**1**	**2**	-	**1**	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO LANGUAGE & COMMUNICATION (PART 1)	**(6L)**
1. El Alfabeto – The Alphabets 2. Numeros – Numbers 3. Saludos - Salutations 4. La hora – The Time Suggested Readings: USO (Basico) Dele Gramatica Epanola **Author by Francisca Castro**	**CO-1** **BTL-1**
MODULE 2: INTRODUCTION TO LANGUAGE & COMMUNICATION (PART 2)	**(6L)**

1. Los Meses, La Semana- The Month, The week and the days of the year 2. Los Estaciones Delan'o – the Seasons of the year 3. En el Aeropuerto, Cpger El Taxi – At the Airport, Booking tickets 4. Hola – Salutations and Greetings 5. Durante La Clase – During the class 6. Art'culos – Different Articles **Suggested Reading: USO (Basico)** **Dele Gramatica Epanola** **Author by Francisca Castro**	**CO-2** **BTL-2**
MODULE 3: UNDERSTANDING OF BASIC VERB AND INTRODUCTION TO GRAMMAR	**(6L)**
1.Verbp ser : Presente – Present tense of Verb "to be" 2. Estar / Hay – Conjucations of the verb "to be" and the verb there is / There are 3. Verbos En Presente: Regulares – Introduction to regular verbs 4. Ser / Estar / Tener – Conjucation of Irregular Verbs **Suggested Reading: USO (Basico)** **Dele Gramatica Epanola** **Author by Francisca Castro**	**CO-3** **BTL-3**
MODULE 4: GRAMMAR AND INTRODUCTION TO BASIC CONCEPT	**(6L)**
1.Posesivos – Possesive Adjectives and Nouns 2. Colores – Colours and Expressions 3. La Familia – The Family and its members 4. Nombres Y Adjectives – Nouns and Adjectives Literary Readings: **USO (Basico)** **Dele Gramatica Epanola** **Author by Francisca Castro**	**CO-4** **BTL-2**
MODULE 5 :	**(6L)**
1.Los nombres de la famila – Name of the Family Members 2. Relaciones – relations 3. Identificación de la tabla de familia - identification of the family table 4. Repaso del semestre entero - Full semester revision Literary Readings: **USO (Basico)**	**CO-5** **BTL-3**

Dele Gramatica Epanola **Author by Francisca Castro**	
TEXT BOOK	
1.	Módulo Mind your Language Institute
E-REFERENCES	
1.	Open.umn.edu
2.	Pdfdrive.com/francisa-castro

COURSE TITLE		**KOREAN**			**CREDITS**	**2**
COURSE CODE		**GLS51014**	**COURSE CATEGORY**	**HS**	**L-T-P-S**	**2-0-0-2**
Version	**0.0**	**Approval Details**			**LEARNING LEVEL**	**BTL- 3**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments / Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"**	**Attendance**	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	Korean language will give you the opportunity to take a deep dive into Korean culture. The students will become more confident with their skills in communicating with their employers and potential customers. This course covers most basic grammatical structure and everyday vocabularies.
Course Objective	1. To make the students get an upper hand in the prime industries of the world and direct access to the Korean speaking community. 2. To enable the students to create a direct connect thereby eliminating the requirement of a translator. 3. To improve the overall personality of the student thereby making them more confident to communicate with global clients. 4. To provide survival skills to students relocating to countries where Korean is spoken.
Course Outcome	1. Develop the spoken Korean and construction of advanced sentences. 2. Enhance conversations & oral understanding of few communication concepts. 3. Create an idea to decode messages and enable a suitable reply in the same manner.

	4. Identify and construct phrases, and other vocabulary. 5. Analyse their language, culture, music, food and other aspects of the Korean Language.

Prerequisites: Plus Two -Intermediate Level

CO, PO AND PSO MAPPING

CO	PO - 1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-2	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-3	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-4	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-5	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION : LANGUAGE AND CULTURE (6L)	
What kind of language is Korean? Korea, philosophy of the Korean language & GangNam Style! In this module, students will learn Korean culture, philosophy of creating Korean scripts, and the Korean alphabet or Korean writing system called 'Hangeul'. After completing the lessons, students will be able to understand the principles how each letter was invented. Also, students will be able to understand Korean sign languages as well. **Suggested Activities:** Memory game	**CO-1** **BTL-1**
MODULE 2: HANGEUL **(6L)**	
Greetings and Introducing phonics, the character system, Noun, Pronoun Basic Verb and Greetings & Introducing. In this module, Students will learn how to greet, ask someone's nationalities / jobs and answer those questions in Korean. After completing the lessons, students will be able to introduce themselves, greet a person and talk about someone's nationalities and occupations. **Suggested activities**: Introducing, Game with song, Flash cards game	**CO-2** **BTL-2**
MODULE 3: RESTAURANT & SHOPPING (6L)	
Reading simple sentence - to be able to comprehend sign board and name, ordering at a restaurant, counting units, Interrogative sentence. In this module, students will learn how to order food and make requests at a restaurant in Korean. After completing the lesson, students will be able to inquire about restaurant menus, order a specific portion of food at a restaurant, and order a drink at a café. After completing the lesson, you will be able to express	**CO-3** **BTL-3**

prices per item, purchase a product from a store, and make a specific request while shopping. **Suggested Activities**: Playing in the condition of restaurant and Shop, Dictation	
MODULE 4: DAILY LIFE & TIME (6L)	
Talking about daily life, expressing movement, memo, simple message, object marker, expression of negation, & writing. In this module, students will learn various Korean vocabulary regarding your daily lives. After completing the lessons, students will be able to utilize informal sentence endings, ask and answer about their everyday life. Students will learn about time and date in Korean. And students will also say the days of the week as well. After completing the lessons, students will be able to ask and respond time & date using Korean numbers. **Suggested activities:** Songs about numbers and family	**CO-4** **BTL-2**
MODULE 5: SPEAKING AND INTERACTION WITH NATIVES (6L)	
Self–Introduction, conversations, finding out information about friends, talk with Korean, visit a Korean market or company. K-POP! Students are able to successfully handle a limited number of uncomplicated communicative tasks related to predictable topics for survival in Korea. **Suggested Activities:** Talk with Native Korean	**CO-5** **BTL-3**

TEXT BOOK	
1.	세종한국어 1 The National Institute of The Korean Language
REFERENCE BOOKS	
1.	[Active Korean 1], Language Education Institute Seoul National University, MoonJin Media
2.	[Practical Korean 1] Darakwon, Korea, Korea
3.	[Korean Language for a Good Job], Darakwon (2007), Korea
E-REFERENCES	
1	https://www.amazon.in/Korean-Made-Simple-beginners-learning- ebook/dp/B00JHT4PCE
2	http://www.twoponds.co.kr/en/snu
3	https://www.koreantopik.com/2017/10/1-8-sejong-korean-textbook-pdfaudio69.html

COURSE TITLE		MANDARIN			CREDITS	2
COURSE CODE		GLS51015	COURSE CATEGORY	HS	L-T-P-S	2-0-0-2
Version	0.0	Approval Details		LEARNING LEVEL		BTL - 3

ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5 %	50%

Course Description	This level of Mandarin language course has been programmed to understand more symbols and grammatical concepts. It simplifies the construction of sentences, making it easy to converse basic sentences. The student will be able to translate texts and also speak relating to weather, climate and self-introduction. An introduction to 'My family' and description using adjectives.
Course Objectives	1. To make the students to understand Mandarin global language , the students get an upper hand in the prime industries of the world and direct access to the Chinese speaking community. 2. To create a direct, connect thereby eliminating the requirement of a translator. 3. To improve the overall personality of the student thereby making him/her more confident to communicate with global clients. 4. To provide survival skills to students relocating to countries where Mandarin is spoken.
Course Outcomes	1. Assimilate the rules of Hanyu pinyin, pronunciation, Mandarin Chinese tones, character-based common vocabulary, fundamental grammar, and oral and writing practices. 2. Differentiate the major tones of Chinese characters and able to identify the similar pronunciation of vocabularies. 3. Practicing basic communicative skills in Mandarin Chinese; through repetition practices in class, students are to learn commonly used Chinese vocabulary, sentences structure and oral communicative skills.

	4. Create an idea to recognize easy and basic Mandarin characters; in addition, students are to learn the regulation of expressing Mandarin Chinese in PinYin system and understand the specific adoption of borrowing from Alphabetic symbols. 5. Apply a knowledge of Mandarin to practice and draw Mandarin Chinese strokes order and characters

Prerequisites: Plus Two -Intermediate Level

CO, PO AND PSO MAPPING

CO	PO - 1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**2**	-	1	-
CO-2	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**2**	**-**	**1**	**-**
CO-3	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**2**	**-**	**1**	**-**
CO-4	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**2**	**-**	**1**	**-**
CO-5	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**2**	**-**	**1**	**-**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE – 1 MANDARIN CHINESE CHARACTER AND TONES	**(6L)**
Basic strokes in Chinese - commonly used radicals - formation of vocabulary - pictograms - ideograms - compound ideographs - phono-semantic compounds - derivative cognates - phonetic loans - 4 tones introduction - consonants - single vowel - double vowels - initial, medial and vowels **Suggested activities:** Direct lecturing, repeated themes lecturing	**CO-1 BTL-2**
MODULE - 2 LISTENING SKILLS	**(6L)**
Listening to native speaker's pronunciation of scripts, vocabularies. Tones differentiating trainings, one character with different pronunciation or tones, different characters with the same pronunciation or tones **Suggested activities:** Listening to native speaker's pronunciation and translate it into English.	**CO-2 BTL-3**
MODULE - 3 SPEAKING SKILLS	**(6L)**

Imitating native speaker's pronunciations, tones and intonations to speak naturally **Suggested activities:** Reverse teaching, presentation, formal and informal conversations, singing Chinese songs, cultural activities, describing things.	**CO-3 BTL-3**
MODULE - 4 READING SKILLS	**(6L)**
50 vocabularies - easy to difficult - important and commonly used - **Suggested activities:** Flashcards to practice, word recognition competition	**CO-4 BTL-3**
MODULE 5 WRITING SKILLS	**(6L)**
15 vocabularies - easy to difficult - important and commonly used - Chinese Calligraphy **Suggested activities:** Only practiced in assignments, not tested in any exams, composition practice (optional)	**CO-5 BTL-3**
TEXT BOOK	
1.	National Taiwan Normal University Mandarin Training Center (2015). Linking publishing company. A Course in Contemporary Chinese (Textbook) 1
REFERENCE BOOK	
1.	National Taiwan Normal University Mandarin Training Center (2017). Linking publishing company. Practical Audio-Visual Chinese Vol. 1, 3rd Edition
E-REFERENCE	
1.	http://chineseworksheetgenerator.org

COURSE TITLE		**JAPANESE**			**CREDITS**	**2**
COURSE CODE		**GLS51016**	**COURSE CATEGORY**	**HS**	**L-T-P-S**	**2-0-0-2**
Version	**0.0**	**Approval Details**			**LEARNING LEVEL**	**BTL- 3**
ASSESSMENT SCHEME						
CIA						**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments / Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"**		**Attendance**	

15%	15%	10%	5%	5%	50%

Course Description	This course has been designed to acquire grammar and be able to use Japanese to communicate in everyday simple and practical situations. The content of this course includes pronunciations speaking skills, listening practice and reading and writing.
Course Objective	1. To make the students to write and speak Japanese easily in any situation, daily life and daily conversations. 2. To develop language skills and interest in learning. 3. To facilitate students to create opportunities for themselves in the society. 4. To develop the spoken language fluently. 5. To help the students to learn about the uniqueness of the Japanese Language.
Course Outcome	Upon the completion of this course, the students will be able to 1. Demonstrate the letters and basic words of Japanese Language which are in daily use. 2. Develops the listening skills of Japanese language. 3. Utilize the letters and common words of the language for communication. 4. Develop the conversational skills. 5.Demonstrate the skill of reading and writing.
Prerequisites: Plus Two -Intermediate Level	
CO, PO AND PSO MAPPING	

CO	PO - 1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	**3**	-	-	-	**1**	-	**1**	-	**1**	**1**	**2**	-	1	-
CO-2	-	**3**	-	-	-	**1**	-	**1**	-	**1**	**1**	**2**	-	**1**	-
CO-3	-	**3**	-	-	-	**1**	-	**1**	-	**1**	**1**	**2**	-	**1**	-
CO-4	-	**3**	-	-	-	**1**	-	**1**	-	**1**	**1**	**2**	-	**1**	-
CO-5	-	**3**	-	-	-	**1**	-	**1**	-	**1**	**1**	**2**	-	**1**	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 – LANGUAGE AND CULTURE	**(6L)**
Greetings - -Self-Introduction - Numbers and Alphabets – Names of countries & Continents- Telling the time-Professions-Introduction about the language and country - Context based learning –At the Café, City orientation, Family, Daily routine ,Weather and Clothing 挨拶--自己紹介-数字とアルファベット-国と大陸の名前-時間を伝える-職業-言語と国についての紹介-コンテキストベースの学習-カフェで、都市オリエンテーション、家族、日常	**CO-1** **BTL-1**

、天気と服装	
MODULE 2 : BASIC GRAMMAR (6L)	
Definite and indefinite articles - Simple verbs and conjugation – Pronouns-Possessive Pronoun-W Questions-Adjectives –Separable verbs 明確な冠詞と不定冠詞-単純な動詞と活用-代名詞-所有代名詞-W 質問-形容詞-分離動詞	**CO-2** **BTL-2**
MODULE 3 : READING & LISTENING SKILLS (6L)	
Reading simple passages - to be able to comprehend advertisements and short texts - Listening comprehension of real time situation based dialogues 簡単な文章を読む-広告や短いテキストを理解できるようにする-リアルタイムの状況に基づいた対話の理解を聞く	**CO-3** **BTL-3**
MODULE 4 : WRITING SKILLS (6L)	
Small passages – Comprehension – Composition – Letter writing 小さな文章–理解–作文–手紙の書き方	**CO-4** **BTL-2**
MODULE 5 : SPEAKING SKILLS (6L)	
Introducing self- describing daily routine – engaging in dialogues about family, city, orientation, ordering food at the café and weather 自己記述的な日常生活の紹介–家族、都市、オリエンテーション、カフェでの食事の注文、天気についての対話に参加する	**CO-5** **BTL-3**
TEXT BOOK	
1.	Minna no Nihongo: main textbook and translation book. (second edition, Elementary level 1-1) Publisher: Goyal Publishers
REFERENCE BOOKS	
1.	Konomi,Emiko.Begginning Japanese for Professionals:Book 1, Portland State University,2015. https://www.academia.edu/81329400/Basic_japanese_A_grammar_and_workbook
E-REFERENCES	
1.	https://www.academia.edu/81329400/Basic_japanese_A_grammar_and_workbook

COURSE TITLE	PRINCIPLES OF PHYSICAL CHEMISTRY			CREDITS	4
COURSE CODE	BCT01007	COURSE CATEGORY	PC	L-T-P-S	3-1-0-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance*	
15%	15%	10%	5%	5%	50%

Course Description	**This course covers the fundamental principles governing the gaseous, liquid, and solid states of matter, along with an introduction to nuclear chemistry. It also develops a strong foundation in thermodynamics through the study of the first and second laws and their applications to chemical systems.**
Course Objective	The course aims at providing an overall view of 1. The physical properties of gases, liquids, solids and X-ray diffraction of solids. 2. Fundamentals of nuclear chemistry and nuclear waste management. 3. Applications of nuclear energy 4. Thermodynamic concepts on chemical processes and applied aspects. 5. Thermochemical calculations.
Course Outcome	Upon completion of this course, the students will be able to 1. Understand and interpret the physical properties of gases, liquids, solids, and X-ray diffraction patterns. 2. Explain nuclear chemistry concepts and assess methods of nuclear waste management. 3. Evaluate the applications and impact of nuclear energy in various fields. 4. Explain the terms and processes in thermodynamics; discuss the various laws of thermodynamics and thermo chemical calculations. 5. Discuss the second law of thermodynamics and its application to heat engine; discuss third law and its application on heat capacity measurement.

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3

CO-1	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-2	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-3	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-4	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-5	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: GASEOUS STATE	**(9L+3T)**
Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; The Maxwell–Boltzmann distribution of speed of molecules-average, root mean square and most probable velocity and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path and viscosity of gases. Real gases: Deviations from ideal gas behaviour, (Andrew's and Amagat'splots); compressibility factor, Z, and its variation with pressure for different gases. Equations of states for real gases–VanderWaal's equation; Virial equation; Boyle temperature; Numerical problems based on equations of states for real gases, isotherms of real gases–critical phenomena–isotherms of CO2 -continuity of state – Vanderwaal's equation and the critical state; law of corresponding states-liquefaction of gases; numerical problems involving the core concepts**.**	**CO-1** **BTL-3**
MODULE 2: LIQUID AND SOLID STATE	**(9L+3T)**
Properties of Liquids – Surface tension, viscosity and their applications. Crystalline and amorphous–differences-geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism. Crystals–size and shape; laws of crystallography; symmetry elements–plane, Centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg's equation. Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO_2; comparison of structure and properties of diamond and graphite; Numerical problems involving core concepts Defects in solids- stoichiometric and non-stoichiometric defects. **Liquid crystals**–classification and applications.	**CO-2** **BTL-3**
MODULE 3: NUCLEAR CHEMISTRY	**(9L+3T)**
Natural radioactivity -α, β and y rays; half-life period; Fajan –Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, mirror nuclei, isodiapheres; nuclear isomerism; radioactive decay series; magic numbers; units– Curie, Rutherford, Roentgen; nuclear stability - neutron- proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and t1/2and radioactive series. Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems to be worked out) Nuclear energy; nuclear fission and fusion–major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.	**CO-3** **BTL-3**

MODULE 4: THERMODYNAMICS I	(9L+3T)
Terminology – Intensive, extensive variables, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics– Concept and significance of heat(q), work(w), internal energy(E), enthalpy(H); calculations of q, w, E and H for reversible, irreversible expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (Cp & Cv); Joule Thomson effect-inversion temperature. Thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions; Hess's law and its applications; determination of bond energy; Measurement of heat of reaction–determination of calorific value of food and fuels Zeroth law of thermodynamics – Absolute Temperature scale.	**CO-4** **BTL-3**
MODULE 5: THERMODYNAMICS II	**(9L+3T)**
Second Law of thermodynamics- Limitations of first law, spontaneity and randomness; Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing, calculation of entropy changes of an ideal gas and a van der Waals gas with changes in temperature, volume and pressure, entropy and disorder. Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation– derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application. Third law of thermodynamics –Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.	**CO-5** **BTL-3**

BOOKS	
1.	B. R. Puri and L. R. Sharma, "Principles of Physical Chemistry", Shoban Lal Nagin Chand and Co., 33rd edition, 1992.
2.	K.L.Kapoor, "A Textbook of Physical chemistry", (volume 2 & 3), Macmillan, India Ltd, 3rd edition, 2009.
3.	P. L. Soni and MohanKatyal, "Textbook of Inorganic Chemistry", Sultan Chand & Sons, 20thedition, 2006.
4.	B.R. Puri, L.R. Sharma, M.S. Pathania; "Principles of Physical Chemistry", 46th edition, Vishal Publishing, 2020.
REFERENCE BOOKS	
1	Maron, S. H. and Prutton C. P. "Principles of Physical Chemistry", The Macmillan Company: Newyork, 4th edition, 1972.
2	Lee, J.D. "Concise Inorganic Chemistry", ELBS William Heinemann: London, 4th edition, 1991.
3	P. W. Atkins, and Julio de Paula, "Physical Chemistry", Oxford University press, 7th edition, 2002.
4	
E Resources for Reference	
1.	https://hagerstowncc.libguides.com/Chemistry2
2.	https://www.pdfnotes.co/rc-mukherjee-physical-chemistry-pdf/
MOOC	
1.	https://nptel.ac.in/courses/104101136Advanced transition metal chemistry
2.	https://nptel.ac.in/courses/112102255Thermodynamics

COURSE TITLE	STEREOCHEMISTRY AND HETEROCYCLIC CHEMISTRY			CREDITS	4
COURSE CODE	BCT01008	COURSE CATEGORY	PC	L-T-P-S	3-1-0-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance*	
15%	15%	10%	5%	5%	50%

Course Description	**This course introduces stereochemistry, including chirality, optical activity, and conformational analysis. It covers the preparation, properties, and reactions of nitro compounds, amines, and important dyes. The course also examines the structure and reactivity of key five- and six-membered heterocyclic compounds.**
Course Objective	This course aims to provide an understanding of 1. Stereoisomerism in chiral and geometric isomerism in olefins, conformations of ethane and butane 2. preparation and properties of aromatic and aliphatic nitro compounds and amines. 3. preparation of different dyes, food colour and additives 4. preparation and properties of five membered heterocycles like pyrrole, furan and thiophene. 5. preparation and properties of six membered heterocycles like pyridine, quinolone and isoquinoline.
Course Outcome	Upon completion of this course, the students will be able to 1. Distinguish between chiral and geometrical isomers. 2. Predict chemical properties and reactions of primary, secondary and tertiary amines. 3. Evaluate the purpose, structure, and safety aspects of common food additives. 4. Describe the aromatic character of pyrrole, furan, and thiophene. 5. Solve organic chemistry problems involving mechanism, synthesis, and prediction of products.

Prerequisites: Knowledge in fundamentals of organic chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

CO-2	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-3	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-4	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-5	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: STEREOCHEMISTRY	**(9L+3T)**
Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans, syn-anti isomerism, E/Z notations. **Optical Isomerism:** Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures – molecules with one and two chiral centres, racemization–methods of racemisation; resolution-methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres. Molecules with no asymmetric carbon atoms–allenes and biphenyls. Conformational analysis of ethane and butane.	**CO-1** **BTL-3**
MODULE 2: CHEMISTRY OF NITROGEN COMPOUNDS-I	**(9L+3T)**
Nitroalkanes Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions–reduction, halogenations, Grignard reagent, Pseudo acid character. Nitro-acinitro tautomerism. **Aromatic nitro compounds** Nomenclature, preparation–nitration from diazonium salts, physical properties; reactions –reduction of nitrobenzene in different medium, Electrophilic substitution reactions, TNT. **Amines: Aliphatic amines** Nomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis, Curtius Schmidt rearrangement. Physical properties, reactions– alkylation, acylation, carbylamine reaction, Mannich reaction, oxidation, basicity of amines.	**CO-2** **BTL-3**
MODULE 3: CHEMISTRY OF NITROGEN COMPOUNDS-II	**(9L+3T)**
Aromatic amines – Nomenclature, preparation – from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid-zwitter ion formation. Distinction between primary, secondary and tertiary amines -aliphatic and aromatic Diazonium compounds. Diazomethane, Benzene diazonium chloride – preparations and synthetic applications. **Dyes -** Theory of colour and constitution; classification based on structure and application; preparation–Martius yellow, aniline yellow, methyl orange, alizarin, indigo, malachite green. Industry oriented content. Dyes Industry, Food colour and additives.	**CO-3** **BTL-3**
MODULE 4: HETEROCYCLIC COMPOUNDS	**(9L+3T)**

Nomenclature and classification. General characteristics-aromatic character and reactivity. Five-membered heterocyclic compounds. Pyrrole – preparation -from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening. Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction. Thiophene synthesis–from acetylene; reactions–reduction; oxidation. Electrophilic substitution reactions.	**CO-4** **BTL-3**
MODULE 5: SIX MEMBERED HETEROCYCLIC COMPOUNDS	**(9L+3T)**
Pyridine – synthesis -from acetylene,Physical properties; reactions -basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution – uses, Condensed ring systems. Quinoline – preparation – Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.	**CO-5** BTL-3

TEXT BOOKS	
1.	D. Nasipuri, "Stereochemistry of organic compounds, Principles and Applications", 3rd Ed. New Age International Publishers, 2018.
2.	M.K. Jain, S.C. Sharma, "Modern Organic Chemistry", Vishal Publishing, 4th reprint, 2009.
REFERENCE BOOKS	
1	R.T. Morrison and R.N. Boyd, "Organic Chemistry", Pearson Education, Asia, sixth edition, 2012.
2	T.W.Graham Solomons, "Organic Chemistry", John Wiley & Sons, 11th edition, 2012.
3	J.A.Joule, and G.F.Smith, "Heterocyclic Chemistry", Wiley, 5th Edition, 2010.
4	A. Carey Francis, "Organic Chemistry", Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition, 2009.
E Resources for Reference	
1.	www.epgpathshala.nic.in
2.	www.nptel.ac.in
3.	http:/swayam.gov.in
MOOC	
1.	https://archive.nptel.ac.in/content/syllabus_pdf/104105034.pdf
2.	https://onlinecourses.nptel.ac.in/noc26_cy34/preview

COURSE TITLE	PREPARATION OF ORGANIC AND INORGANIC COMPOUNDS			CREDITS	2
COURSE CODE	BCT01403	COURSE CATEGORY	PC	L-T-P-S	0-0-4-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

CIA					ESE
Experimental	Calculation	Result	Viva	Record	
20%	10%	10%	5%	5%	50%

Course Description	**This course provides hands-on training in synthesizing selected organic and inorganic compounds using standard laboratory procedures. It emphasizes purification, characterization, and safe laboratory practices in chemical preparation.**
Course Objective	This course aims at providing knowledge on 1. Preparation of organic compounds 2. Preparation of Inorganic compounds 3. Crystallization of crude sample. 4. Determination of boiling and melting point of organic compounds
Course Outcome	Upon completion of this course, the students will be able to 1. explain the method of preparation of organic compounds 2. discuss the preparation of inorganic compounds. 3. find out the physical constants of organic compounds. 4. explain the purification of crude sample.

Prerequisites: Knowledge in fundamentals of organic chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-2	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-3	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-4	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-5	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: PREPARATION OF ORGANIC COMPOUNDS	(20P)
i. Nitration-picric acid from Phenol ii. Halogenation-p-bromo acetanilide from acetanilide iii. Oxidation-benzoic acid from Benzaldehyde iv. Benzoic acid from Benzamide v. Methyl benzoate to Benzoic acid vi. Salicylic acid from Methyl Salicylate vii. Rearrangement- Benzil to Benzilic Acid Viii. Methyl orange from sulphanilic acid	**CO-1** **BTL-3**
MODULE 2: PREPARATION OF INORGANIC COMPOUNDS	**(20P)**
i. Potash alum ii. Tetraammine copper (II) sulphate iii. Hexammine cobalt (III) chloride iv. Mohr's Salt v. Hexathiourea lead (II)nitrate vi. Sodium ferrioxalate vii. Tris thiourea copper (I) chloride viii. Sodium cobalt nitrate Purification of organic / inorganic compounds by crystallization(from water/alcohol) and distillation.	**CO-2,3** **BTL-3**
MODULE 3: DETERMINATION OF BOILING POINT AND MELTING POINT OF ORGANIC SUBSTANCE / SOLVENTS (20P)	
Experiments for demonstration 1. **Steam distillation** - Extraction of essential oil from citrus fruits/eucalyptus leaves. 2. **Chromatography(anyone (Group experiment)** (i) Separation of amino acids by Paper Chromatography (ii) Thin Layer Chromatography-mixture of sugars/plant pigments/permanganate , dichromate. (iii) Column Chromatography-extraction of carotene, chlorophyll and xanthophylls from leaves/ separation of anthracene- anthracene picrate. 3. **Electrophoresis–**Separation of amino acids and proteins. 4. Isolation of casein from milk/Determination of saponification value of oil or fat/Estimation of acetic acid from commercial vinegar. (Any one Group experiment)	**CO-4** **BTL-3**

BOOKS	
1.	Manna, A.K. "Practical Organic Chemistry", Books and Allied: India, 2018.
2.	Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. "Basic Principles of Practical Chemistry", Sultan Chand: New Delhi, 2nd ed., 2012.
REFERENCE BOOKS	
1	Gurtu, J.N; Kapoor , R. "Advanced Experimental Chemistry (Organic)", Sultan Chand: New Delhi, 1987.
2	Furniss ,B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. "Vogel's Textbook of Practical organic Chemistry", Pearson: India, 5th Edi., 1989.

E Resources for Reference	
1.	https://www.vlab.co.in/broad-area-chemical-sciences
2.	Massive Open Online Courses in Chemistry: A Comparative Overview of Platforms and Features | Journal of Chemical Education
3.	
MOOC	
1.	Learn with MOOCs about Chemistry | Free Online Courses | My Mooc
2.	olabs.edu.in/?sub=73&brch=8&sim=116&cnt=1

COURSE TITLE	**INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**			**CREDITS**	**3**
COURSE CODE	**BCT01009**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	**This course introduces modern analytical instruments such as UV–Vis, IR, NMR, chromatography, and electroanalytical methods. It emphasizes principles, instrumentation, and data interpretation for accurate chemical analysis.**
Course Objective	This course aims at providing an overall view of the 1. Operation and troubleshooting of chemical instruments 2. Fundamentals of analytical techniques and its application in the characterization of compounds 3. Theory of chromatographic separation 4. Theory of thermo/electro analytical techniques 5. Stoichiometry and the related concentration terms

Course Outcome	Upon completion of this course, the students will be able to 1. apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption spectrometry 2. explain theory, instrumentation and application of UV visible and Infrared spectroscopy. 3. able to discuss instrumentation, theory and applications of thermal and electrochemical techniques 4. explain the use of chromatographic techniques in the separation and identification of mixtures 5. explain preparation of solutions, stoichiometric calculations.

Prerequisites: Knowledge in fundamentals of chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: QUALITATIVE AND QUANTITATIVE ASPECTS OF ANALYSIS	**(9L)**
S.I Units, Distinction between Mass and Weight. Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids. Stoichiometry Calculations. Sampling, evaluation of analytical data, Errors – Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation, Coefficient of Variation, Confidence Limits, Q- test, F-test, T-test. The Least Square Method for Deriving Calibration plots.	**CO-1** **BTL-3**
MODULE 2: ATOMIC ABSORPTION SPECTROSCOPY	**(9L)**
Basic principles of instrumentation- choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.	**CO-2** **BTL-3**
MODULE 3: UV-VISIBLE AND IR SPECTROSCOPY	**(9L)**
Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. **UV-Visible Spectrometry:** Basic principles, instrumentation – choice of source, monochromator and detector for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers.	**CO-3** **BTL-3**

Infrared Spectroscopy: Basic principles of instrumentation - choice of source, monochromator & detector for single and double beam instrument; sampling techniques.	
MODULE 4: THERMAL AND ELECTRO-ANALYTICAL METHODS OF ANALYSIS	**(9L)**
TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate DSC-Principle, Instrumentation and applications. Electroanalytical methods: polarography - principle, instrumentation and applications. Derivative polarography- Cyclic Voltammetry - principle.	**CO-4** **BTL-3**
MODULE 5: SEPARATION AND PURIFICATION TECHNIQUES	**(9L)**
Classification, principle, Factors affecting –Solvent Extraction – Liquid -Liquid Extraction, Chromatography: Column, TLC, Paper, Gas, HPLC and Electrophoresis, Principle, Classification, Choice of Adsorbents, Solvents, Preparation of Column, Elution Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms and Rf value.	**CO-5** BTL-3

BOOKS	
1.	Skoog, Holler and Crouch, “Principles of Instrumental Analysis”, Cengage Learning, 6th Edi., 2017.
2.	R.Gopalan, P.S.Subramanian and K.Rengarajan, “Elementsof Analytical Chemistry”, Sultan Chand, New Delhi, 2007.
REFERENCE BOOKS	
1	Christian, G.D, “Analytical Chemistry”, John Wiley & Sons, New York, 6th Ed., 2004.
2	Dash U.N, “Analytical Chemistry; Theory and Practice”, Sultan Chand and sons Educational Publishers, New Delhi, 2011.
3	V. K. Ahluwalia, “Instrumental Methods of Chemical Analysis”, Springer, 2023.
4	
E Resources for Reference	
1.	http://eric.ed.gov/?id=EJ386287
2.	http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14-final.pdf
3.	http://www.chemistry.co.nz/stoichiometry.htm
MOOC	
1.	Advances in Instrumentation and Chemical Data Analysis - Course
2.	nptel.ac.in/courses/103108100

COURSE TITLE	FUNDAMENTALS OF APPLIED PHYSICS			CREDITS	4
COURSE CODE	BPH01003	COURSE CATEGORY	PC	L-T-P-S	2-1-2-0
VERSION	0.0	APPROVAL DETAILS		LEARNING LEVEL	BTL – 3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Practical Assessments	Observation / Lab records as approved by the Department as approved by the Department Examination Committee 'DEC"	Attendance	ESE
15%	15%	10%	5%	5%	Theory 25% Practical 25%

Course Description	**This course introduces physics concepts essential for chemical sciences, including atomic and molecular physics, optical and photonic interaction of light with matter, electrochemistry, spectroscopy, quantum confinement, thin-film phenomena, computational physics, and radioactivity. The course emphasizes modern applications such as chemical sensing, materials analysis, nanotechnology, and radiochemical techniques.**
Course Objectives	6. To understand atomic and molecular structure through quantum and spectroscopic principles. 7. To describe the physics behind optical, laser and photonic technologies used in chemical sensing. 8. To analyse electrochemical systems, ion transport, electrode potentials and radioactive processes. 9. To explain vibrational, rotational and electronic spectroscopy including FTIR, Raman and UV–Vis. 10. To introduce quantum confinement, thin-film physics, and computational methods relevant to chemical science
Course Outcomes	Upon completion of this course, students will be able to: 6. Explain atomic and molecular transitions and relate them to chemical analysis. 7. Demonstrate knowledge of optical, laser and photonic techniques used in spectroscopy and sensing. 8. Apply electrochemical and radioactive principles to chemical systems and instrumentation. 9. Interpret Raman, FTIR, UV - Vis spectra using physical principles. 10. Utilize computational and quantum confinement principles in chemical problem-solving and material study

Prerequisites: Knowledge in fundamental level of Physics at school level.

CO, PO AND PSO MAPPING

COs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO1	3	-	1	2	3	1	2	-	1	-	-	3	3	2	1

CO2	**3**	**-**	**1**	**2**	**3**	**1**	**2**	**-**	**1**	**-**	**-**	**3**	**3**	**2**	**1**
CO3	**3**	**-**	**1**	**2**	**3**	**1**	**2**	**-**	**1**	**-**	**-**	**3**	**3**	**2**	**1**
CO4	**3**	**-**	**1**	**2**	**3**	**1**	**2**	**-**	**1**	**-**	**-**	**3**	**3**	**2**	**1**
CO5	**3**	**-**	**1**	**2**	**3**	**1**	**2**	**-**	**1**	**-**	**-**	**3**	**3**	**2**	**1**
1 - Weakly Correlated, 2 - Moderately Correlated and 3 - Strongly Correlated															

Module 1: ATOMIC AND MOLECULAR PHYSICS	**(9L+6P)**
Atoms: Atomic structure – Bohr's model – Quantum Numbers – Fine structure – Zeeman and Stark effects **Molecules:** Molecular energy levels – Rotational, Vibrational and Electronic transitions – Potential energy curves – Force constants – Molecular bonding and spectroscopy – Elemental analysis and molecular identification. **Practical components:** Determination of wavelength separation of sodium D lines using diffraction grating - Frank-Hertz experiment to study atomic excitation (simulation).	**CO-1** **BTL-3**
Module 2: OPTICS AND PHOTONICS	**(9L+6P)**
Microscopy & Polarization Optics: Mirrors/lenses/prisms – focal length measurements – aberrations in lenses – optical microscopy – magnification – resolution – imaging techniques. Polarization – polarizer – analysers – Malus law – polarizing beam splitter (BS) – half-wave plate (HWP) – quarter wave plate (QWP) – wavelength filters **Photonics:** Photons – Light propagation in waveguides and photonic crystals – Interaction with plasmonic nanostructures – Surface Plasmon Resonance (SPR) – Ultrafast Laser chemistry – Laser Induced Breakdown spectroscopy (LIBS). **Practical components:** Malus law with polarizers - Determination of wavelength of laser using diffraction grating.	**CO-2** **BTL-3**
Module 3: ELECTROCHEMISTRY AND RADIOACTIVITY	**(9L+6P)**
Electrochemistry: Electrolytic conduction – Ionic mobility – Transport Number – Nernst equation – EMF of electrochemical cell – Concentration cells – Batteries – Fuel cells. **Radioactivity:** Radio-isotopes – α, β, γ decay – Decay rate – Decay constant – Half-life – Radiometric dating – Radiation detectors (GM tube and scintillation). **Practical component:** Verification of Nernst equation using concentration cell - Conductivity measurement of strong and weak electrolytes.	**CO-3** **BTL-3**
Module 4: SPECTROSCOPY	**(9L+6P)**
Rotational: Raman scattering – Stokes and anti-stokes transitions – Raman shift – Molecular fingerprinting – Raman spectroscopy. **Vibrational:** FT-IR spectroscopy – Michelson interferometer – Interferogram – Fourier Transform principles – IR absorption bands. **Electronic transition:** UV-visible spectroscopy – Beer-Lambert law – Solvent effects. **Practical component:** Interpretation of FTIR spectrum (fingerprint region analysis) - Study of UV-vis absorption study of organic/inorganic samples.	**CO-4** **BTL-3**
Module 5: QUANTUM CONFINEMENT AND COMPUTATIONAL PHYSICS	**(9L+6P)**

Quantum Physics: Quantum confinement – Density of states (DoS) – Classification of materials based on DoS – Quantum dots – Size-dependent bandgap – 2D materials – Graphene – Single layered and Multilayered Graphene – Thin film deposition techniques – Interference based thickness measurement. **Computational Physics:** Numerical methods (root finding, integration) – Fourier analysis – SHM simulation – Decay simulation – Spectral Fitting. **Practical component:** Simple thin film coating and thickness measurement - Simulation of radioactive decay or particle in a 1D box.	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Eugene Hecht, A. R. Ganesan, "Optics", Pearson, 5th edition, 2019.
2.	Nicholas P. Butch, Efrain E. Rodriguez and Johnpierre Paglione, "Fundamentals of Quantum Materials A Practical Guide to Synthesis and Exploration", World Scientific Publishing Company, 2021.
REFERENCE BOOKS	
1.	Andrew Pohorille and Christophe Chipot, "Chemical Physics", Springer Series, 2007.
2.	Grant Ritchie and Devinder Sivia, "Foundations of Physics for Chemists", Oxford Chemistry Primers, 2000.
3.	
E BOOKS	
1.	https://dl.iranchembook.ir/ebook/organic-chemistry-2753.pdf
2.	http://www.rnlkwc.ac.in/pdf/study-material/chemistry/Spectroscopy.pdf
3.	https://www.mn.uio.no/fysikk/english/research/publications/other/radioactivity-xrays.pdf
4.	https://emineter.wordpress.com/wp-content/uploads/2015/03/g-k-woodgate-elementary-atomic-structure-oxford-university-press-usa-1983.pdf
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc23_cy19/preview
2.	https://courses.middlebury.edu/hub/mcug/202110/phys/0230a

COURSE TITLE		ENGLISH FOR COMPETITIVE EXAMINATIONS			CREDITS	1
COURSE CODE		GLS51006	COURSE CATEGORY	HS	L-T-P-S	0-0-2-1
VERSION	1.0	APPROVAL DETAILS			LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment	Second Periodical Assessment	Weekly assignment/ lab record and viva as approved by the Department Examination Committee "DEC"	Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"	Attendance	Practical	Theory
15 %	15 %	10 %	5 %	5 %	25 %	25 %

Course Description	**This course provides students with the skills and strategies needed to succeed in competitive exams, such as English grammar, vocabulary, reading and writing skills, listening comprehension, and critical thinking. It also helps them to understand the English language and exam structure better.**
Course Objective	1. To provide an environment where people may compete on both a formal and casual level and employ those abilities in regular conversation, presentations, group discussions, and debates. 2. To prepare the students to read literary materials, comprehend them, and respond to questions based on them. 3. Assisting students in developing social awareness and positive responses to societal demands. 4. To give students a setting in which to take competitive exams.
Course Outcome	Upon completion of this course, the students will be able to; 1. Acquire knowledge of the structure and format of competitive examinations. 2. Develop vocabulary and grammar to increase success in competitive examinations. 3. Create critical thinking and problem-solving skills to answer complex questions.

	4. Analyse their vocabulary and communication ability to build the knowledge of idioms, phrasal verbs and commonly used expressions for better productivity, job performance and to develop self-confidence. 5. Learn how to approach and solve comprehension and essay questions with confidence.

Prerequisites:- Intermediate Level

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-2	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-3	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-4	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-
CO-5	-	3	-	-	-	1	-	1	-	1	1	2	-	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 : INTRODUCTION TO COMPETITIVE EXAMS	**(3L+3P)**
Introduction to Competitive Exams - IELTS, TOEFL etc., Precis writing – Types of Letter writing – Business Letters – Letters for employability	**CO-1** **BTL-2**
MODULE 2 : READING COMPREHENSION	**(3L+3P)**
Reading Comprehension- Cloze Test- Passage Completion-Practice Test – Listening Comprehension Exercise (Lab)	**CO-2** **BTL-3**
MODULE 3 : ERROR CORRECTION	**(3L+3P)**
Spotting Errors- Sentence Improvement-Practice Test	**CO-3** **BTL-3**
MODULE 4 : VOCABULARY TEST	**(3L+3P)**
Para Jumbles- Tracing Odd Sentences- Synonyms and Antonyms-Practice Test	**CO-4** **BTL-3**
MODULE 5: GENERAL GRAMMAR	**(3L+3P)**
Idioms and Phrases, One Word Substitution, Active and Passive Voice, Direct-Indirect Speech-Practice Tests	**CO-5** **BTL-3**

TEXT-BOOK	
1.	General English for Competitive Exams, by Dr. Rashmi Singh, 2nd Edition
REFERENCEBOOKS	
1.	TOEFL
E-REFERENCES	
1.	https://www.careers360.com/all-ebooks
2.	https://www.dishapublication.com/ebooks
3.	https://www.visionias.net/p/free-e-books-for-all-competitive.html
4.	https://www.fdaytalk.com/ebooks/
MOOC	
1.	https://www.mooc-list.com/tags/english

COURSE TITLE	**INORGANIC POLYMERS AND METAL COMPLEXES**			**CREDITS**	**4**
COURSE CODE	**BCT01010**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	**This course introduces the fundamental principles of coordination chemistry, including nomenclature, isomerism, bonding theories, metal carbonyls, and f-block elements. It also explores the preparation, structure, and applications of inorganic polymers along with concepts such as crystal field theory, magnetic behavior, stability, and Jahn–Teller effects.**

Course Objective	The course aims to provide knowledge on 1. nomenclature, isomerism and theory of coordination compounds, and chelate complexes. 2. crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect. 3. preparation and properties of metal carbonyls. 4. Lanthanoids and actinoids. 5. Preparation and properties of inorganic polymers.
Course Outcome	Upon completion of this course, the students will be able to 1. Apply IUPAC rules to name coordination compounds and classify types of isomerism associated with them. 2. Explain bonding in coordination complexes using Werner's Theory, VBT, and Crystal Field Theory. 3. Discuss the preparation, structure, and bonding characteristics of metal carbonyls 4. Compare the electronic configuration, oxidation states, magnetic properties, and chemical behavior of lanthanoids and actinoids. 5. Explain the preparation methods, structural features, and important properties of inorganic polymers.

Prerequisites: Knowledge in fundamentals of inorganic chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: CO-ORDINATION CHEMISTRY-I **(9L+3T)**

IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds. Werner's coordination theory – effective atomic number –interpretation of geometry and magnetic properties by Pauling's theory–geometry of co- ordination compounds with co-ordination number 4 & 6. Chelates – types of ligands forming chelates – stability of chelates, applications of chelates in qualitative and quantitative analysis–application of DMG and oxine in gravimetric analysis–estimation of hardness of water using EDTA, metal ion indicators. Role of metal chelates in living systems–hemoglobin and chlorophyll.	**CO-1** **BTL-3**

MODULE 2: CO-ORDINATION CHEMISTRY-II	(9L+3T)
Crystal field theory –Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy(CFSE), Spectro chemical series – calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting, crystal field effect on ionic radii, lattice energies, heats of ligation with water as a ligand (heat of hydration), interpretation of magnetic properties, spectra of $[Ti(H_2O)_6]^{3+}$ - Jahn – Teller effect. Stability of complexes in aqueous solution, stability constants - factors affecting the stability of a complex ion, thermodynamic and kinetic Stability(elementary idea).Comparison of VBT and CFT.	**CO-2** **BTL-3**
MODULE 3: ORGANO METALLIC COMPOUNDS	**(9L+3T)**
Metal Carbonyls - Mono and polynuclear carbonyls, General methods of preparation of carbonyls – general properties of binary carbonyls – bonding in carbonyls– structure and bonding in carbonyls of Ni, Fe, Cr, Co, Mn, Ru and Os. EAN rule as applied to metal carbonyls. Ferrocene – Methods of preparation, physical and chemical properties.	**CO-3** **BTL-3**
MODULE 4: INNER TRANSITION ELEMENTS (LANTHANOIDS AND ACTINOIDS)	**(9L+3T)**
General characteristics of f-block elements - Comparative account of lanthanoids and actinoids - Occurrence, Oxidation states, Magnetic properties, Colour and spectra –Lanthanoids and Actinoids, Separation by ion-Exchange and Solvent extraction methods - Lanthanoids contraction- Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate.	**CO-4** **BTL-3**
MODULE 5: INORGANIC POLYMERS	**(9L+3T)**
General properties – classification of inorganic polymers based on element in the backbone (Si, S, B and P) – preparation and properties of silicones (poly dimethyl siloxane and poly methyl hydro siloxane) phosphorous based polymer(polyphosphazines and poly phosphonitrilic chloride), sulphur-based polymer (poly sulfide and polymeric sulphur nitride), boron-based polymers (borazine polymers) – industrial applications of inorganic polymers.	**CO-5** BTL-3

BOOKS	
1.	Puri. B.R, Sharma. L.R, Kalia.K.C, "Principles of Inorganic Chemistry", 31th edition, Milestone Publishers & Distributors, Delhi, 2011.
2.	Satya Prakash, Tuli. G.D., Basu.S.K., Madan. R.D., "Advanced Inorganic Chemistry, 18th Edition, S.Chand & Co., New Delhi, 2009.
REFERENCE BOOKS	
1	Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, "Inorganic Chemistry", Oxford University Press, 6th edition, 2014.
2	Sivasankar. B, "Inorganic Chemistry". Ist Edition, Pearson, Chennai, 2013.
3	Gopalan. R, "Inorganic Chemistry for Undergraduates, Ist Edition, University Press (India) Private Limited, Hyderabad, 2009.
4	Madan R.D, Sathya Prakash, "Modern Inorganic Chemistry, 2nd ed ., S. Chand and Company, New Delhi, 2003.
E Resources for Reference	
1.	www.epgpathshala.nic.in

2.	www.nptel.ac.in
3.	http:/swayam.gov.in
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc26_cy21/preview
2.	https://onlinecourses.nptel.ac.in/noc26_cy08/preview

COURSE TITLE	**CHEMICAL THERMODYNAMICS AND KINETICS**			**CREDITS**	**4**
COURSE CODE	**BCT01011**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	**The course imparts an extensive knowledge and understanding about the various concepts of thermodynamics, various chemical and photochemical reactions based on kinetics, theories of reaction rate, heterogeneous and homogeneous catalysis-mechanism, colloids, photochemistry and applications.**				
Course Objective	The course aims at providing an overall view of 1. Gibbs free energy, Helmholtz free energy, Ellingham's diagram and partial molar properties. 2. Chemical kinetics and different types of chemical reactions. 3. Adsorption, homogeneous and heterogeneous catalysis. 4. Colloids and macromolecules. 5. Photochemistry, fluorescence and phosphorescence.				

Course Outcome	Upon completion of this course, the students will be able to 1. Explain Gibbs and Helmholtz free energy functions, partial molar quantities and Elling hams . 2. Apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation. 3. Compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogenous and heterogeneous catalysis. 4. Demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules. 5. Utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.

Prerequisites: Knowledge in fundamentals of physical chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: THERMODYNAMICS - III	**(9L+3T)**
Free energy and work functions – Need for free energy functions, Gibbs free energy, Helmholtz free energy – their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application. Partial molar properties – chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, chemical potential of a system of ideal gases, Gibbs-Duhem – Margules equation. **Suggested Readings:** Basics of thermodynamics and partial molar properties	**CO-1** **BTL-3**
MODULE 2: CHEMICAL KINETICS	**(9L+3T)**
Rate of reaction – Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. Order and molecularity of simple and complex reactions, Rate laws - Rate constants – derivation of rate constants and characteristics for zero, first order, second and third order (equal initial concentration) – Derivation of time for half change with examples. Methods of determination of order of Volumetry, manometry and polarimetry. Effect of temperature on reaction rate – temperature coefficient – concept of activation energy – Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction – Failure of collision theory. Lindemann's theory of unimolecular	**CO-2** **BTL-3**

reaction. Theory of absolute reaction rates – Derivation of rate constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT. Complex reactions – reversible and parallel reactions (no derivation and only examples) –kinetics of consecutive reactions – steady state approximation. **Suggested Readings:** Rate of reaction, theories of reaction rate and complex reactions	
MODULE 3: SURFACE CHEMISTRY AND CATALYSIS	**(9L+3T)**
Adsorption – Chemical and physical adsorption and their general characteristics – distinction between them. Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory, kinetics of enzyme catalyzed reaction – Michaelis-Menten and Briggs - Haldene equation – Line weaver- Burk plot – inhibition – reversible – competitive, noncompetitive and uncompetitive (no derivation of rate equations) Catalysis – general characteristics of catalytic reactions, autocatalysis, promoters, negative catalysis, poisoning of a catalyst – theories of homogenous and heterogeneous catalysis – Kinetics of Acid–base and enzyme catalysis. **Suggested Readings:** Adsorption, isotherms, theories and catalysis	**CO-3** **BTL-3**
MODULE 4: COLLOIDS AND SURFACE CHEMISTRY	**(9L+3T)**
Colloids: Types of Colloids, Characteristics of Colloids (Lyophilic and Lyophobic sols), Preparation of Sols - Dispersion methods, aggregation methods, Properties of Sols - Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties- Electro-osmosis, Electrophoresis, Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels-preparation of Gels, Applications of colloids **Suggested Readings:** Colloids, properties and applications	**CO-4** **BTL-3**
MODULE 5: PHOTOCHEMISTRY	**(9L+3T)**
Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of H2-Cl2, H2-Br2and H2-I2reactions, comparison between thermal and photo chemical reactions. Fluorescence – applications including fluorimetry – sensitized fluorescence, phosphorescence – applications – chemiluminescence and photo sensitisation – examples Chemistry of Vision – 11 cis retinal – vitamin A as a precursor - colour perception of vision. **Suggested Readings:** Photochemistry, photo chemical reactions, applications	**CO-5** BTL-3

BOOKS

1.	B. R. Puri and L. R. Sharma, "Principles of Physical Chemistry", Shoban Lal Nagin Chand and Co., 48th edition, 2021.
2.	Peter Atkins, and Julio de Paula, James Keeler, "Physical Chemistry", Oxford University press, International eleventh edition, 2018
3.	Arun Bahl, B. S. Bahl, G. D. Tuli, "Essentials of physical chemistry", S. Chand & Co., 28 th edition, 2019.
4.	S. K. Dogra and S. Dogra, "Physical Chemistry through Problems", New Age International, 4th edition, 1996.
5.	J. Rajaram and J.C. Kuriacose, "Thermodynamics", Shoban Lal. Nagin Chand and CO., 1986

REFERENCE BOOKS

1	J. Rajaram and J. C. Kuriacose, "Chemical Thermodynamics", Pearson, 1st edition, 2013.
2	Keith. J. Laidler, "Chemical kinetics", Pearson, 3rd edition, 2003.
3	P. W. Atkins, and Julio de Paula, "Physical Chemistry", Oxford University press, 7th edition, 2002.
4	K. L. Kapoor, "A Text book of Physical Chemistry", Macmillan 90 India Ltd, 3rd edition, 2009.
E Resources for Reference	
1.	https://www.kotapointedu.in/2020/06/physical-chemistry-by-narendra-awasti.html
2.	https://www.pdfnotes.co/rc-mukherjee-physical-chemistry-pdf/
MOOC	
1.	https://www.my-mooc.com/en/mooc/introduction-to-physical-chemistry/

COURSE TITLE	**NATURAL PRODUCTS AND ORGANIC REACTIONS**			**CREDITS**	**4**
COURSE CODE	**BCT01012**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	**This course introduces the classification, extraction, and properties of natural products such as alkaloids and terpenes. It covers the preparation and chemistry of saccharides along with the structure and functions of major biomolecules. The course also includes key molecular rearrangements and the synthesis and reactivity of organometallic compounds.**				
Course Objective	This course aims at providing knowledge on 1. classification, isolation and discussing the properties of alkaloids and terpenes 2. preparation and properties of saccharides 3. biomolecules 4. different molecular rearrangement 5. the fundamental principles of green chemistry				

Course Outcome	Upon completion of this course, the students will be able to 1. Explain the classification, isolation techniques, structural features, and chemical properties of alkaloids and terpenes. 2. Describe the preparation, structure, stereochemistry, and reactions of mono-, di-, and polysaccharides. 3. Understand the structure, roles, and biological significance of key biomolecules 4. Analyze major molecular rearrangements and predict products based on mechanistic pathways. 5. Apply green chemistry concepts to design safer, cleaner, and more sustainable chemical synthesis.

Prerequisites: Knowledge in fundamentals of organic chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: ALKALOIDS AND TERPENES	**(9L+3T)**
Alkaloids Classification, isolation, general properties-Hofmann Exhaustive Methylation; Structure elucidation – Coniine, piperine, nicotine; Chemical synthesis of piperine. **Terpenes:** Classification, Isoprene rule, isolation and structural elucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor; Synthesis of Menthol.	**CO-1** **BTL-3**
MODULE 2: CARBOHYDRATES	**(9L+3T)**
Carbohydrates Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer's Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples. **Monosaccharides**–configuration–D and L hexoses – aldo hexoses and ketohexoses. Glucose, Fructose – Occurrence, preparation, properties, reactions, structural elucidation, uses. Interconversions of sugar series–ascending, descending, aldose to ketose and ketose to aldose. **Disaccharides**–sucrose, lactose, maltose- preparation, properties and uses (no structural elucidation). **Polysaccharides**–Source, constituents and biological importance of homopolysaccharides–starch and cellulose, heteropolysaccharides– Hyaluronic acid, heparin.	**CO-2** **BTL-3**
MODULE 3: MOLECULAR REARRANGEMENT	**(9L+3T)**

Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Clasien, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement.	**CO-3** **BTL-3**
MODULE 4: SPECIAL REAGENTS IN ORGANIC SYNTHESIS	**(9L+3T)**
Special reagents in organic synthesis - AIBN,9BBN,BINAP/BINOL,BOC,DABCO,DCC,DIBAL, DMAP, NBS/NCS, NMP, PCC, TBHP,TEMPO Organo metallic compounds in Organic Synthesis - Preparation, Properties and applications: Grignard Reagents, Organo Lithium Compounds, Ziegler–Natta, Wilkinson, Metal Carbonyl, Zeiss's Salt.	**CO-4** **BTL-3**
MODULE 5: GREEN CHEMISTRY	**(9L+3T)**
Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media–green solvents, green reagents and catalysts; tools used like microwave and ultra-sound in chemical synthesis.	**CO-5** BTL-3

TEXT BOOKS	
1.	C. Bandyopadhya; "An Insight into Green Chemistry", 2020
2.	Arun Bahl and B.S. Bahl, "Advanced organic chemistry", S. Chand & Company Pvt. Ltd., Multi Colour edition, New Delhi, 2012.
REFERENCE BOOKS	
1	R.T. Morrison and R.N. Boyd, "Organic Chemistry", Pearson Education, Asia, 6th edition, 2012.
2	T.W. Graham Solomons, "Organic Chemistry", John Wiley & Sons, 11th edition, 2012.
3	A. Carey Francis, "Organic Chemistry", Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 7th edition, 2009.
4	J.A. Joule, and G.F. Smith, "Heterocyclic Chemistry", Wiley, 5th Edition, 2010.
E Resources for Reference	
1.	www.epgpathshala.nic.in
2.	www.nptel.ac.in
3.	http:/swayam.gov.in
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc26_cy12/preview
2.	https://onlinecourses.swayam2.ac.in/cec26_cy04/preview

COURSE TITLE	PHYSICAL CHEMISTRY PRACTICAL			CREDITS	2
COURSE CODE	BCT01404	COURSE CATEGORY	PC	L-T-P-S	0-0-4-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

CIA					ESE
Experimental	Calculation	Result	Viva	Record	
20%	10%	10%	5%	5%	50%

Course Description	**Physical Chemistry Practical introduces experimental techniques to study physicochemical properties such as viscosity, conductivity, kinetics, and thermodynamics. The course strengthens analytical skills through hands-on measurements, data analysis, and interpretation.**
Course Objective	This course aims at providing 1. Basic principles of physical chemistry experiments 2. Hands on experience in carrying out the experiments
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the principles and methodology for the practical work. 2. Explain the procedure, data and methodology for the practical work 3. Apply the principles of phase rule and electrochemistry for carrying out the practical work 4. Demonstrate laboratory skills for safe handling of the equipment and chemicals

Prerequisites: Knowledge in fundamentals of physical chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-2	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-3	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-4	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3
CO-5	3	1	3	3	3	3	3	1	3	1	2	3	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: THERMOMETRIC EXPERIMENTS (20P)

1. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent 2. Determination of molecular weight of organic compound by transition temperature method. 3. Simple eutectic-determination of eutectic temperature and composition of naphthalene- Diphenyl amine or naphthalene-diphenyl system. 4. Determination of upper critical solution temperature of phenol– water system; Study of the effect of impurity on CST and determination of the strength of unknown.	**CO-1** **BTL-3**
MODULE 2: CHEMICAL KINETICS	**(20P)**
1. Determination of rate constant of acid catalyzed hydrolysis of an ester - methylacetate. 2. Determination of order of reaction between iodide and persulphate (initial rate method). 3. Polarimetry: Determination of rate constant of acid catalysed inversion of cane sugar Thermochemistry 1. Determination of heat of neutralization of a strong acid by a strong base. 2. Determination of heat of hydration of copper sulphate.	**CO-2,3** **BTL-3**
MODULE 3: ELECTROCHEMISTRY–CONDUCTANCE MEASUREMENTS	**(20P)**
1. Conductometric titration of hydrochloric acid against sodium hydroxide 2. Potentiometric titration of ferrous ion against potassium dichromate using quinhydronde electrode. Adsorption 1. Construction of Freundlich isotherm for the adsorption of acetic acid on activated charcoal. **Experiments for demonstration:** Distribution law 1. Determination of the distribution co-efficient of iodine between carbon tetrachloride and water. 2. Determination of equilibrium constant of the reaction $I_2 + I^- \rightarrow I_3^-$ Determination of concentration of the given potassium iodide solution using the above equilibrium constant. **Electrochemistry** 1. Determination of cell constant and molar conductance of strong electrolyte. 2. Determination of dissociation constant of acetic acid. Colorimetry 1. Determination of concentration of copper sulphate solution.	**CO-4** **BTL-3**

BOOKS	
1.	Sindhu, P.S. “Practicals in Physical Chemistry”, Macmillan India : New Delhi, 2005.
2.	Khosla, B. D. Garg, V. C.; Gulati, A. “Senior Practical Physical Chemistry”, R. Chand : New Delhi, 2011.
REFERENCE BOOKS	
1	Gupta, Renu, “Practical Physical Chemistry”, New Age International : New Delhi, 1st Ed., 2017.
2	Charu Arora, Sumantra Bhattacharya, “Advanced Physical Chemistry Practical Guide”, Bentham Science, 2022.
E Resources for Reference	

1.	https://www.vlab.co.in/broad-area-chemical-sciences
2.	ChemCollective
3.	Virtual Chemistry Experiments
MOOC	
1.	Free Course: Laboratory skills for chemistry from The Open University | Class Central
2.	Introduction to Physical Chemistry | Coursera

COURSE TITLE	**QUALITY CONTROL AND QUALITY ASSURANCE**			**CREDITS**	**2**
COURSE CODE	**BCT01013**	**COURSE CATEGORY**	**SE**	**L-T-P-S**	**2-0-0-1**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	**This course introduces the principles and practices of Quality Control and Quality Assurance essential for chemical and pharmaceutical industries. It equips students with skills in analytical validation, documentation, regulatory standards, and quality management systems.**				
Course Objective	1. To introduce fundamental quality concepts, QC–QA principles, and the importance of quality systems in chemical industries. 2. To familiarize students with sampling techniques, statistical tools, and error analysis used in quality evaluation. 3. To develop skills in method validation, calibration, and instrumental quality control. 4. To provide knowledge on GMP, GLP, ISO standards, and documentation practices. 5. To enable students to understand regulatory guidelines, stability studies, and quality risk management.				

Course Outcome	Upon completion of this course, the students will be able to 1. Explain the concepts of QC, QA, TQM, and their roles in ensuring chemical product quality and apply appropriate sampling and statistical quality tools to evaluate chemical data. 2. Perform and interpret method validation and calibration procedures for analytical instruments. 3. Demonstrate understanding of GMP, GLP, ISO 9001 and ISO 17025 quality systems. 4. Prepare, maintain, and interpret essential quality documentation and audit reports. 5. Evaluate regulatory guidelines and perform basic quality risk assessment in chemical and pharmaceutical operations.

Prerequisites: Knowledge in fundamentals of general chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: BASICS OF QUALITY CONCEPTS	**(6L)**
Introduction to quality: definitions, dimensions of quality, need for quality in chemical industries - Concepts of QC and QA – differences and scope - Total Quality Management (TQM): principles, quality planning, quality auditing - Quality costs, documentation, SOPs, Good Laboratory Practices (GLP).	**CO-1** **BTL-3**
MODULE 2: SAMPLING AND STATISTICAL QUALITY CONTROL	**(6L)**
Sampling methods: random, stratified, composite, grab sampling - Sampling techniques for liquids, solids, gases - Statistical tools in QC: accuracy, precision, standard deviation, variance, confidence limits - Control charts: X–bar, R, p and np charts; interpretation and applications.	**CO-2** **BTL-3**
MODULE 3: VALIDATION, CALIBRATION, AND INSTRUMENTAL QC	**(6L)**
Method validation: specificity, linearity, limit of detection, limit of quantification, robustness, ruggedness - Calibration of analytical instruments: UV–Vis, IR, pH meter, conductivity meter, analytical balance - Internal and external quality control; use of reference standards and certified materials.	**CO-3** **BTL-3**
MODULE 4: QUALITY SYSTEMS IN CHEMICAL AND PHARMACEUTICAL INDUSTRIES	**(6L)**

Good Manufacturing Practices (GMP): principles and guidelines - ISO standards (ISO 9001, ISO 17025): structure and requirements - Quality audits, corrective and preventive actions (CAPA) - Documentation: batch records, QC reports, validation reports.	**CO-4** **BTL-3**
MODULE 5: REGULATORY ASPECTS AND CASE STUDIES	**(6L)**
Regulatory bodies: BIS, FDA, WHO, ICH guidelines - Stability testing protocols and shelf-life determination - Quality risk management: risk assessment tools (FMEA, HACCP) - Case studies from chemical, food, and pharmaceutical industries.	**CO-5** BTL-3

BOOKS	
1.	S. S. Dara, "Engineering Chemistry", S. Chand & Company Pvt. Ltd., 2010.
2.	Y. Anjaneyulu & M. Marayya Reddy, "Quality Assurance and Quality Control in Analytical Chemical Laboratories", CRC Press (Taylor & Francis Group), 2005.
REFERENCE BOOKS	
1	P. P. Sharma, "Cosmetics, Drugs and Medical Devices – Quality Assurance Practices", Vandana Publications, 2006.
2	K. S. Boss, "Pharmaceutical Quality Assurance", Elsevier India / New Age International, 2014.
3	Piotr Konieczka, "Quality Assurance and Quality Control in the Analytical Chemical Laboratory-A Practical Approach", CRC Press, 3rd Edi., 2026.
4	
E Resources for Reference	
1.	https://www.iso.org
2.	https://www.fda.gov/regulatory-information/search-fda-guidance-documents
3.	
MOOC	
1.	https://nptel.ac.in/courses/113/106/113106063
2.	https://www.who.int/medicines/areas/quality_safety/quality_assurance

COURSE TITLE	**SUMMER INTERNSHIP**			**CREDITS**	**4**
COURSE CODE	**BCT01800**	**COURSE CATEGORY**	**SI**	**L-T-P-S**	**0-0-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-6**

ASSESSMENT SCHEME

First Review	**Second Review**	**Third Review**	**ESE**
20%	**20%**	**10%**	**50%**

Course Description	**The Summer Internship provides students with an immersive, hands-on experience in a professional setting. This course is designed to bridge the gap between academic learning and**

	practical application, offering students the opportunity to engage in real-world chemical research and industry practices. Students will work under the guidance of experienced professionals, gaining valuable insights and skills that will enhance their academic and career prospects.
Course Objective	1. To provide practical experience in a professional chemistry environment. 2. To develop technical skills in laboratory techniques, data analysis, and chemical research. 3. To enhance problem-solving abilities and critical thinking in a research context. 4. To improve scientific communication skills through report writing and presentations. 5. To understand and apply safety protocols and ethical standards in a laboratory setting.
Course Outcome	Upon completion of this course, the students will be able to 1. develop advanced laboratory techniques and hands-on experience with scientific instruments, improving their ability to conduct independent research and experiments in chemistry. 2. gain proficiency in collecting, analysing, and interpreting experimental data, leading to stronger analytical and problem-solving skills. 3. enhance their ability to communicate scientific findings through written reports and oral presentations. 4. apply safety protocols and ethical standards in a laboratory. 5. acquire valuable experience working in a professional environment, collaborating with multidisciplinary teams, and networking with industry experts.
Prerequisites: Knowledge of Chemistry and basic scientific exposure.	

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3
CO-2	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3
CO-3	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3
CO-4	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3
CO-5	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

COURSE TITLE	VERBAL REASONING AND INTERVIEW SKILLS			CREDIT	1
COURSE CODE	GLS51007	COURSE CATEGORY	HS	L-T-P-S	0 – 0 – 2 -0
Version	1.0	Approval Details		LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment	Second Periodical Assessment	Practical	Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"	Attendance	Theory	Practical
15 %	15%	10 %	5 %	5 %	25 %	25 %

Course Description	**This course seeks to enhance their verbal thinking abilities and employment skills. In the course, students learn how to use their newly acquired speaking skills to compete in the outside world. Students who participate in this course will master the speaking techniques necessary to maximize their potential through practice with verbal reasoning.**
Course Objective	1. To enhance verbal thinking skills for ordinary public speaking. 2. To assist students in becoming better debaters and verbal analysts by preparing them with verbal analyses. 3. To improve speaking abilities and advance to the right stage using thinking abilities. 4. Gaining the capacity to evaluate one's speaking abilities and put them to use in practice. 5. Making recommendations on how to strengthen your verbal communication skills through regular practice.
Course Outcome	Upon completion of this course, the students will be able to 1. Illustrate verbal ability skill. 2. Develop verbal reasoning ability to improve logical reasoning skills. 3. Analyse language strategies and techniques for speaking in formal and informal professional contexts. 4. Enhance the ability to use linguistic structures and vocabulary in professional contexts. 5. Develop the ability to prepare and present professional skills and knowledge in a convincing manner.

Prerequisites: Intermediate Level

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3

CO-1	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**2**	**-**	**1**	**-**
CO-2	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**2**	**-**	**1**	**-**
CO-3	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**2**	**-**	**1**	**-**
CO-4	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**2**	**-**	**1**	**-**
CO-5	**-**	**3**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**2**	**-**	**1**	**-**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: VERBAL REASONING SKILLS	**(3L+P)**
Introduction to Verbal Reasoning – Analogy – Classification - Coding-Decoding - Blood Relations - Puzzle Test - Sequential Output Tracing - Direction Sense Test - Logical Sense Test - Logical Venn Diagrams - Alphabet Test	**CO-1** **BTL-2**
MODULE 2 : PRACTICING VERBAL REASONING QUESTIONS	**(3L+P)**
Practice on – Logic - Statement Arguments reasoning-ability - Statement Assumptions - Statement Courses of Action - Statement Conclusions - Deriving Conclusion From Passages - Theme Detection - Cause and Effect Reasoning	**CO-2** **BTL-3**
MODULE 3 : UNDERSTANDING INTERVIEW	**(3L+P)**
What is an Interview? - Types of Interviews - Other assessment methods – Why do interviews take place? What Happens in an interview – What are interviews about? What leads to Success in Interviews ? Providing proof that you are the right candidate – the most common mistakes – De-mystifying the interview – Stressing your contribution	**CO-3** **BTL-3**
MODULE 4: LANGUAGE ACCURACY IN INTERVIEW	**(3L+P)**
Importance of personal Image – creating a positive first impression – appearance – Behaviour – confidence – positive mental attitude – the journey – voice – controlling nerves – Giving a presentation – types of presentation – preparing a presentation – rehearsing your presentation – using visual aids.	**CO-4** **BTL-3**
MODULE 5: PROFESSIONAL PRESENTATION OF THE PERSONAL SKILLS AND KNOWLEDGE	**(3L+P)**
Examples of Interview questions and answers – dealing with tricky situations – internal vacancies – money – Step-by-step checklist – learning from experience – other sources of help.	**CO-5** **BTL-4**
TEXT BOOKS	

1	Aggarwal. R.S. (2018). A Modern Approach To Verbal Reasoning. S Chand Publishing; 2nd edition. India
2	Corfield. Rebecca(2019). Successful Interview Skills. Kogan Page Limited. London.
REFERENCE BOOKS	
1.	Examcart Experts. (2021). Examcart Latest Complete VERBAL & LOGICAL REASONING Practice Book For All Type of Government and Entrance Exam (Bank, SSC, Defense, Management (CAT, XAT GMAT), Railway, Police, Civil Services). Agrawal Examcat.India
2.	Lucents (2019), Verbal Reasoning in English for All Competitive Exams, Lucents Publications. India.
3.	Kumar. Krishan(2018). Personal Interview Skills. Friends Publications India. India.
E BOOKS	
1.	https://ccsuniversity.ac.in/bridge-library/magzine/Interview-Skills.pdf
2.	https://cdn.preterhuman.net/texts/employment/Interview%20Skills%20that%20Win%20the%20Job%20Simple%20techniques%20for%20answering%20all%20the%20tough%20questions%20-%20MICHAEL%20SPIROPOULOS.pdf
MOOC	
1.	https://www.coursera.org/specializations/english-interview-resume
2.	https://learning.tcsionhub.in/courses/career-creator/advanced-verbal-ability-online-course/

COURSE TITLE	**BIOINORGANIC AND INDUSTRIAL INORGANIC CHEMISTRY**			**CREDITS**	**4**
COURSE CODE	**BCT01014**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	

15%	15%	10%	5%	5%	50%

Course Description	**This course examines the role of inorganic elements in biological systems, including tracer elements, iron metabolism, metalloenzymes, and oxygen transport. It also covers the chemistry and applications of silicates, refractories, alloys, paints, and pigments in various industries.**
Course Objective	The course aims to provide knowledge on 1. Tracer elements and their role in the biological system. 2. Iron transport and storage 3. Metallo enzymes, oxygen transport. 4. Silicates and their applications 5. Industrial applications of refractories, alloys, paints and pigments
Course Outcome	Upon completion of this course, the students will be able to 1. Explain the role of tracer elements in biological systems and their applications in metabolic, diagnostic, and therapeutic processes. 2. Describe the mechanisms of iron transport and storage in living organisms, including the functions of transferrin, ferritin, and related biomolecules. 3. Discuss the structure and function of metalloenzymes and analyze oxygen transport mechanisms in biological systems. 4. Explain the structure, classification, and applications of silicates in various industrial and technological fields. 5. Analyze the composition, properties, and industrial applications of refractories, alloys, paints, and pigments.

Prerequisites: Knowledge in inorganic chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: BIOINORGANIC CHEMISTRY (9L+3T)

Essential and trace elements: Role of Na^+, K^+, Mg^{2+}, Ca^{2+}, Fe^{3+},Cu^{2+} and Zn^{2+} in biological systems. Effect of excess intake (Toxicity) of Metal ions – trace elements - As, Cd, Pb, Hg.	**CO-1 BTL-3**
MODULE 2: METAL ION TRANSPORT AND STORAGE	**(9L+3T)**
Iron–storage, transport-Transferrin and Ferretin; Iron-porphyrins–myoglobin, haemoglobin–oxygen transport –Bohr effect; Sodium/potassium pump, calcium pump; transport and storage - copper and zinc.	**CO-2 BTL-3**
MODULE 3: METALLOENZYMES	**(9L+3T)**
Isomerase and synthetases, structure of cyanocobalamin (VitaminB12), nature of Co-C bond; Metallo enzymes - functions of carboxy peptidase A, zinc metallo enzyme – mechanism and uses, Zn-Cu enzyme – structure and function, carbonic anhydrase, Vitamin B-12 as transferase and isomerase - Iron-sulphur proteins - 2Fe-2S – rubredoxin, 4Fe-2S – ferridoxin, Iron sulphur cluster enzymes. In vivo and Invitro nitrogen fixation–biological functions of nitrogenase and molybdo enzymes.	**CO-3 BTL-3**
MODULE 4: SILICATES	**(9L+3T)**
Introduction – general properties of silicates, structure – types of silicates – ortho silicates (zircon), pyro silicates (thortveitite), chain silicates (pyroxenes), ring silicates (beryl), sheet silicates (talc, mica, asbestos), silicates having three-dimensional structure (feldspars, zeolites, ultramarines)	**CO-4 BTL-3**
MODULE 5: INDUSTRIAL APPLICATIONS OF INORGANIC COMPOUNDS	**(9L+3T)**
Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti- skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels. Nanocomposite Hydrogels: synthesis, characterization and uses.	**CO-5** BTL-3

BOOKS	
1.	Puri B. R, Sharma L.R, Kalia K. C. "Principles of Inorganic Chemistry", Milestone Publishers & Distributors, 31ST Edi., New Delhi, 2011.
2.	W. V. Malik, G.D. Tuli, R.D. Madan, "Selected Topics in Inorganic Chemistry", S. Chand and Company Ltd, 2000.
REFERENCE BOOKS	
1	Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, "Inorganic Chemistry", Oxford University Press, 6th edition, 2014.
2	Sivasankar B, "Inorganic Chemistry" Pearson, Chennai, 1st Edi., 2013.
3	GopalanR, "Inorganic Chemistry for Under graduates, University Press (India) Private Limited, Hyderabad, 1st Edi., 2013.
4	Madan R. D, Sathya Prakash, "Modern Inorganic Chemistry", S. Chand and Company, New Delhi, 2003.
E Resources for Reference	
1.	www.epgpathshala.nic.in
2.	www.nptel.ac.in
3.	http:/swayam.gov.in
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc26_cy19/preview
2.	https://onlinecourses.nptel.ac.in/noc26_cy23/preview

<table>
<tr><td>COURSE TITLE</td><td colspan="3">PHASE RULE AND ELECTROCHEMICAL SYSTEMS</td><td>CREDITS</td><td>4</td></tr>
<tr><td>COURSE CODE</td><td>BCT01015</td><td>COURSE CATEGORY</td><td>PC</td><td>L-T-P-S</td><td>3-1-0-0</td></tr>
<tr><td>Version</td><td>0.0</td><td>Approval Details</td><td></td><td>LEARNING LEVEL</td><td>BTL-3</td></tr>
<tr><td colspan="6">ASSESSMENT SCHEME</td></tr>
<tr><td colspan="5">CIA</td><td rowspan="2">ESE</td></tr>
<tr><td>First Periodical Assessment</td><td>Second Periodical Assessment</td><td>Seminar/Assignments/Project</td><td>Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC””</td><td>Attendance*</td></tr>
<tr><td>15%</td><td>15%</td><td>10%</td><td>5%</td><td>5%</td><td>50%</td></tr>
<tr><td>Course Description</td><td colspan="5">The course imparts a fundamental principle of physical chemistry, including phase equilibria, chemical equilibrium, and separation techniques for liquid mixtures. Students will explore conductance theories, electrochemical cells, and EMF measurements while applying key thermodynamic and kinetic concepts.</td></tr>
<tr><td>Course Objective</td><td colspan="5">The course aims at providing an overall view of
1. Phase diagram of one and two component systems.
2. Chemical equilibrium.
3. Separation techniques for binary liquid mixtures.
4. Electrical conductance and transport number.
5. Galvanic cells, EMF and significance of electrochemical series.</td></tr>
<tr><td>Course Outcome</td><td colspan="5">Upon completion of this course, the students will be able to
1. Construct the phase diagram for one component and two component systems, explain the properties of freezing mixture, component with congruent melting points and solid solutions.
2. Apply the concepts of chemical equilibrium in dissociation of PCl5, N2O4and formation of HI, NH3, SO3 and decomposition of calcium carbonate. Demonstrate important principles such as Le chatelier principle, van’t Hoff reaction isotherm and Clausius-Clayperon equation.
3. Identify an appropriate distillation method for these parathion of binary liquid mixtures such as azeotropic mixtures, partially miscible mixtures and immiscible liquids.
4. Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch’s law in conductance.
5. Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations.</td></tr>
<tr><td colspan="6">Prerequisites: Knowledge in physical chemistry.</td></tr>
</table>

CO, PO AND PSO MAPPING															
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-2	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-3	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-4	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-5	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: PHASE RULE	**(9L+3T)**
Definition of terms; derivation of phase rule ; application to one component systems–water and sulphur - super cooling, sublimation; two component systems–solid liquid equilibria –simple eutectic(lead- silver and bismuth - cadmium), freezing mixtures (potassium iodide water),compound formation with- congruent melting points (magnesium–zinc and ferric chloride–water system), peritectic change(sodium–potassium), Solid solution(gold-silver);copper sulphate– water system.	**CO-1** **BTL-3**
MODULE 2: CHEMICAL EQUILIBRIUM	**(9L+3T)**
Law of mass action–thermodynamic derivation–relationship between Kp and Kc –application to the homogeneous equilibria – dissociation of PCl5 gas, N2O4gas –equilibrium constant and degree of dissociation - formation of HI, NH3 ,and SO3–heterogeneous equilibrium – decomposition of solid calcium carbonate – Le chatelier principle –van'tHoff reaction isotherm– temperature dependence of equilibrium constant – van't Hoff reaction isochore – Clayperon equation – Clausius Clayperon equation and its applications.	**CO-2** **BTL-3**
MODULE 3: BINARY LIQUID MIXTURES	**(9L+3T)**
Ideal liquid mixtures–non ideal solutions–azeotropic mixtures– Fractional distillation–partially miscible mixtures–phenol-water, Triethyl amine-water, nicotine-water–effect of impurities on critical solution temperature; immiscible liquids- steam distillation; Nernst Distribution law–applications.	**CO-3** **BTL-3**
MODULE 4: ELECTRICAL CONDUCTANCE AND TRANSFERENCE	**(9L+3T)**
Arrhenius theory of electrolytic dissociation – Ostwald's dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory –Onsager equation (no derivation), significance of Onsager equation, Debye Falkenhagen effect, Wien effect. Ionic mobility – Discharge of ions on electrolysis (Hittorf's theoretical device),transport number–determination– Hittorf's method, moving boundary method–factors affecting transport number – determination of ionic mobility; Kohlrausch's law- applications; molar ionic conductance and viscosity (Walden's rule); applications of conductance measurements–determination of-degree of dissociation of weak electrolyte, dissociation constant of weak acid and weak base, ionic product of water, solubility and solubility product of sparingly soluble salts-conductometric titrations–acid base titrations.	**CO-4** **BTL-3**
MODULE 5: GALVANIC CELLS AND APPLICATIONS	**(9L+3T)**
Galvaniccell,representation,reversibleandirreversiblecells,EMFand its measurement – standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of are action,	**CO-5** BTL-3

Thermodynamics and EMF – calculation of ΔG, ΔH, and ΔS from EMF data; reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes–metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series – applications of electro chemical series. Chemical cells with and without transport, concentration cells with and without transport; Applications of EMF measurements Applications of EMF measurements– determination of activity	

BOOKS	
1.	B. R. Puri and L. R. Sharma, "Principles of Physical Chemistry", Shoban Lal Nagin Chand and Co., 48th edition, 2021.
2.	Peter Atkins, and Julio de Paula, James Keeler, "Physical Chemistry", Oxford University press International, 11th edition, 2018
3.	Arun Bahl, B. S. Bahl, G. D. Tuli, "Essentials of physical chemistry", S. Chand & Co., 28th edition, 2019.
4.	S. K. Dogra and S. Dogra, "Physical Chemistry through Problems: New Age International", 4th edition, 1996.
REFERENCE BOOKS	
1	D.N. Bajpai, "Advanced Physical Chemistry", S. Chand & Co., 2001.
2	K. L. Kapoor, "A Text book of Physical Chemistry", Macmillan 90 India Ltd, 3rd edition, 2009.
3	P. W. Atkins, and Julio de Paula, "Physical Chemistry", Oxford University press, 7th edition, 2002.
4	Chatterjee, S. "Introduction to Electrochemistry", Discovery Publishing House Pvt Ltd, 2016.
E Resources for Reference	
1.	https://www.kotapointedu.in/2020/06/physical-chemistry-by-narendra-awasti.html
2.	https://www.pdfnotes.co/rc-mukherjee-physical-chemistry-pdf/
MOOC	
1.	https://www.my-mooc.com/en/mooc/introduction-to-physical-chemistry/

COURSE TITLE	**INDUSTRIAL SAFETY AND HAZARD MANAGEMENT**			**CREDITS**	**2**
COURSE CODE	**BCT01016**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-0-0-1**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination**	**Attendance***	

			Committee "DEC""		
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	**This course provides foundational knowledge on industrial safety practices, hazard identification, and risk management essential for chemical and allied industries. Students gain skills in chemical hazard control, emergency planning, and regulatory compliance.**
Course Objective	1. To introduce the fundamental concepts of industrial safety and various types of hazards in chemical industries. 2. To familiarize students with chemical hazard classifications and appropriate control measures. 3. To train students in hazard identification, risk assessment, and preventive safety strategies. 4. To provide knowledge on national and international safety regulations and industrial safety systems. 5. To develop students' ability to handle emergencies, manage disasters, and analyse industrial case studies.
Course Outcome	Upon completion of this course, the students will be able to 1. Understand the principles of industrial safety and classify different types of hazards. 2. Interpret chemical hazard information, SDS/MSDS, and apply correct control measures. 3. Conduct basic hazard identification and risk assessment using standard tools (HAZOP, FMEA, etc.). 4. Explain Indian and global safety regulations applicable to chemical industries. 5. Demonstrate knowledge of emergency response, disaster management, and first-aid procedures and analyse major industrial accidents and propose preventive and mitigation strategies.

Prerequisites: Knowledge in fundamentals of chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO INDUSTRIAL SAFETY	**(6L)**
Concept of safety: definitions, need for safety in chemical industries - Types of industrial hazards: physical, chemical, biological, ergonomic, mechanical - Accident causation theories; accident investigation and reporting - Safety culture and behaviour-based safety.	**CO-1** **BTL-3**
MODULE 2: CHEMICAL HAZARDS AND CONTROL MEASURES	**(6L)**

Toxic chemicals: classification, routes of exposure, dose–response relationship - Flammable, explosive, corrosive, oxidizing, and reactive chemical hazards - Control measures: engineering controls, administrative controls, PPE - Material Safety Data Sheets (MSDS/SDS) – structure and interpretation.	**CO-2** **BTL-3**
MODULE 3: HAZARD IDENTIFICATION AND RISK ASSESSMENT	**(6L)**
Hazard identification techniques: HAZOP, FMEA, Fault Tree Analysis (FTA), Event Tree Analysis (ETA) - Risk assessment matrix, risk evaluation, and prioritization - Safe handling, storage, and transportation of chemicals - Environmental hazards: air, water, and soil contamination control.	**CO-3** **BTL-3**
MODULE 4: INDUSTRIAL SAFETY SYSTEMS AND REGULATIONS	**(6L)**
Fire safety: fire triangle, fire extinguishers, fire suppression systems - Safety devices: alarms, detectors, relief valves, interlocks - Indian safety regulations: Factories Act, Environmental Protection Act, Chemical Accidents Rules - International regulations: OSHA, REACH, GHS classification and labelling.	**CO-4** **BTL-3**
MODULE 5: EMERGENCY MANAGEMENT AND CASE STUDIES	**(6L)**
Emergency planning: onsite and offsite emergency plans - Disaster management: preparedness, mitigation, response, recovery - First aid, spill management, evacuation procedures - Case studies: Bhopal gas tragedy, Chernobyl, Flixborough, Visakhapatnam LG Polymers incident.	**CO-5** BTL-3

BOOKS	
1.	K. U. Mistry, “Industrial Safety and Environment”, Nirali Prakashan, 2017.
2.	D. S. Kumar, “Industrial Safety”, S. Chand & Company Pvt. Ltd., 2018.
REFERENCE BOOKS	
1	R. K. Jain & Sunil S. Rao, “Industrial Safety, Health and Environment Management Systems”, Khanna Publishers, 2015.
2	H. K. Chopra, “Industrial Safety Management”, Mercury International, 2016.
3	L. M. Deshmukh, “Industrial Safety Management: Hazard Identification and Risk Control”, McGraw Hill Education (India) Private Limited, 1st Edition, 2005.
4	
E Resources for Reference	
1.	https://www.osha.gov
2.	https://ndma.gov.in
3.	https://unece.org/ghs
MOOC	
1.	https://nptel.ac.in/courses/112/107/112107214
2.	https://swayam.gov.in/nd1_noc20_ge06

COURSE TITLE	RESEARCH PROJECT			CREDITS	7
COURSE CODE	BCT01801	COURSE CATEGORY	RP	L-T-P-S	0-0-14-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-6

ASSESSMENT SCHEME

First Review	Second Review	Third Review	ESE
20%	20%	10%	50%

Course Description	**The project will include several of the following components: planning and carrying out a research project in chemistry, based on literature survey and preliminary results, Production of data, structuring and adequate interpretation of them; setting up and testing hypotheses; finding and making uses of new literature; writing a research project report.**
Course Objective	1. To make the students sound scientific knowledge of their selected project topic. 2. To expose the students and train them on problem identification, formulation and solution. 3. To make the students design solutions to complex problems. 4. To expose the students and train them on interpretation of the results. 5. To make the students sound knowledge in research paper writing and presentation.
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate a sound scientific knowledge of their selected project topic. 2. Undertake problem identification, formulation and solution. 3. Design solutions to complex problems utilising a scientific approach. 4. Communicate with scientists and the community at large in written and oral forms. 5. Demonstrate the knowledge, skills and attitudes of a researcher.

Prerequisites: Knowledge of Chemistry and basic scientific exposure.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3
CO-2	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3
CO-3	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3
CO-4	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3
CO-5	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

COURSE TITLE	PHARMACEUTICAL CHEMISTRY			CREDITS	3
COURSE CODE	BCT01500	COURSE CATEGORY	DE	L-T-P-S	2-1-0-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance*	
15%	15%	10%	5%	5%	50%

Course Description	**This course covers the design, synthesis, analysis, and development of drugs and other medicinal compounds.**
Course Objective	1. Understanding the fundamentals of chemical structures, reactions, and synthesis; 2. Learning to design, develop, and analyze drugs; gaining skills in pharmaceutical analysis, 3. Quality control, and manufacturing processes; and applying this knowledge to solve problems in drug discovery 4. Ensure the safe and effective use of medicines
Course Outcome	Upon completion of this course, the students will be able to 1. Students will be able to suggest suitable analgesics for the ailment. 2. Students will be able to design antihistamines and antimalarial drugs 3. Students can correlate different types of sulpha drugs 4. Students can apply drugs to lower blood pressure 5. Students can correlate nanomedicine and conventional medicine.

Prerequisites: Knowledge in organic chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

CO-5	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: ANALGESICS AND ANTIPYRETICS	**(6L+3T)**
Introduction to pharmaceutical chemistry analgesics - Narcotic analgesics – Morphine analogues and its modification – Codeine – synthetic narcotic analgesics – Pethidines and methodones – Narcotic antagonists – Nalorphine – Antipyretic analgesics – pyrazole – salicylic acid – p-aminophenol derivatives – aspirin and salol derivatives – barbiturates – benzodiazepines.	**CO-1** **BTL-3**
MODULE 2: ANTIHISTAMINES AND ANTIMALARIALS	**(6L+3T)**
Antihistamines – mode of action of antihistamines – ethylene diamine, ethanolamine, propylamine – cyclizine – phenothazine – Antimalarials – Life cycle of plasmodium species – classification – quinine – 4-amino and 8-amino quinolines – pyrimidines, acridines	**CO-2** **BTL-3**
MODULE 3: ANTIBIOTICS	**(6L+3T)**
Antibiotics – Penicillin – Semisynthetic penicillin – Chloramphenicol – Streptomycin – Cephalosporin – antifungals – Nystatin – Griseofulvin – Sulpha drugs – Sulphathiazole – Sulphamerazine – Sulpha guanidine- Sulphanilamide – Sulphadiazine – Methanism of action – uses	**CO-3** **BTL-3**
MODULE 4: ANTIHYPERTINSICE AND HYPOTENSIVE DRUGS	**(6L+3T)**
Antihypertensive and hypotensive drugs – mechanism of lowering blood pressure – α –methyl dopa – Pargyline – Bertyline – Hydralazine – Propranolol – Antitubercular drugs – PAS- INH – Ethambutol, Rifampicin – Pyrazinamide, Antiarythmic agents	**CO-4** **BTL-3**
MODULE 5: ANTINEOPLASTIC DRUGS AND NANOMEDICINES	**(6L+3T)**
Antineoplastic drugs – alkylating agents – nitrogen mustards – aziridines – sulphonic acid esters – 1,2 – epoxides – antimetabolites – folic acid and pyrimimide antagonists – vinca alkaloids, hormones- oral contraceptives – nanomedicines – carbon nanotubes - Polymeric nanoparticles - Solid lipid nanoparticles - Polymeric micelles – Dendrimers – Liposomes - Gold nanoparticles - Magnetic nanoparticles – fullerenes	**CO-5** BTL-3

BOOKS	
1.	A. Berger, “Medicinal Chemistry”, Wiley Inter science, New York, Vol. I and II, 2010.
2.	Bentley and Driver’s, “Text book of Pharmaceutical Chemistry”, revised by L. M. Artherden, Oxford University Press, London, 2015.
REFERENCE BOOKS	
1	Wilson O, Giswold O, and George, F, “Text book of Organic, Medicinal and Pharmaceutical Chemistry”, Lippincott Company, Philadelphia, 1991.
2	Wilkinson J. M, “Nanotechnology applications in medicine”. Med. Device Technol. 2003.
3	Roco M C, “Nanotechnology: convergence with modern biology and medicine.” Curr. Opin. Biotechnol. Vol 14, 2003.
4	
E Resources for Reference	
1.	Free Chemistry Tutorial - Pharmaceutical chemistry -I | Udemy
2.	Domain Track: Pharmaceutical Chemistry – Courseware :: Centurion University
3.	
MOOC	

1.	my-mooc.com/en/mooc/drug-discovery-medicinal-chemistry-5b0892ea-fa51-4743-aa74-b10281bc2a73
2.	Medicinal Chemistry MOOC and Free Online Courses | MOOC List

COURSE TITLE	**MATERIAL SCIENCE**			**CREDITS**	**3**
COURSE CODE	**BCT01501**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	**This course describes the fundamental relationship between a material's structure, processing, properties, and performance.**
Course Objective	1. The main objectives of a materials science course are to provide a foundational understanding of materials 2. To enable students to apply this knowledge to solve real-world engineering problems. 3. This includes learning how to select, design, and process materials for various applications 4. Developing skills in characterization, analysis, and problem-solving
Course Outcome	Upon completion of this course, the students will be able to 1. select suitable materials for the application. 2. find the mechanical properties of materials. 3. construct phase diagrams of materials 4. differentiate between materials 5. suggest characterization of nanomaterials.

Prerequisites: Knowledge in general chemistry.

CO, PO AND PSO MAPPING

CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**

CO-1	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-2	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-3	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-4	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-5	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION	**(6L+3T)**
Selection criteria and processes: General criteria of selection of materials in process industries. Properties: Mechanical, Thermal, Chemical, Electrical, Magnetic and Technological properties. Processing of Metals and Alloys- Casting, Hot and cold rolling, Forging, Extrusion, Deep drawing	**CO-1 BTL-3**
MODULE 2: MECHANICAL BEHAVIOUR	**(6L+3T)**
Elastic, Anelastic and Viscoelastic Behaviour – Plastic Deformation by Slip: Critical resolved shear stress, Mechanism of Creep, Creep Resistant Materials – Fracture: Ductile and Brittle , Fatigue fracture, Griffith's theory, S-N curves , Fracture toughness	**CO-2 BTL-3**
MODULE 3: PHASE DIAGRAMS AND PHASE TRANSFORMATION	**(6L+3T)**
Gibb's Phase rule : Uniary and Binary phase diagrams , Al2O3 - Cr2O3 , Pb-Sn, Ag-Pt and Iron- Iron Carbide Phase Diagram – Lever rule – Invariant reactions- TTT diagrams – Micro structural changes – Nucleation and growth – Martensitic transformations – Solidification and Crystallization – Glass transition – Recrystallization and Grain growth	**CO-3 BTL-3**
MODULE 4: FERROUS, NON-FERROUS METALS AND COMPOSITES	**(6L+3T)**
Pig iron, Cast iron, Mild Steel-properties, Applications and Manufacturing methods; Stainless steels, Special Alloy steels-properties and uses; Heat treatment of plain-carbon steels - Manufacturing methods of Lead, Tin and Magnesium. Properties and applications in process industries - FRP-Fiber Reinforced Plastics (FRP), Different types of manufacturing methods; Asphalt and Asphalt mixtures; Wood	**CO-4 BTL-3**
MODULE 5: NANOMATERIALS	**(6L+3T)**
Introduction to Nanotechnology- Zero-Dimensional Nano Structures – Nano particles – One Dimensional Nano Structures- Nano wires and Nano rods – Two-Dimensional Nano Structures, Films – Special Nano Materials - Nano Structures fabricated by Physical Techniques – Characterization and Properties of Nano Materials – Applications of Nano Structures.	**CO-5** BTL-3

BOOKS

1.	Khanna O P, "Material Science and metallurgy", Dhnapat Rai Publications, 2015.
2.	Raghavan V, "Materials and Engineering" Prentice Hall of India, New Delhi, 2006.

REFERENCE BOOKS

1	Brenner D, "Hand book of Nanoscience and technology", 2002.
2	Henry R Clauster, "Industrial and Engineering materials" McGraw Hill Book Co., 1975.
3	Kingery W D and Bowen H K and Unimann D R, "Introduction to Ceramics" Jhon Wiley and sons, 2nd Edi., 1991.
4	Fahrner W R, "Nanotechnology and Nanoeletronics" Springer International edition, 2005.

E Resources for Reference

1.	Reference Resources - Materials Science and Engineering - Library Guides at Penn State University

2.	https://ftp.idu.ac.id/wp-content/uploads/ebook/tdg/TEKNOLOGI REKAYASA MATERIAL PERTAHANAN/Materials Science and Engineering An Introduction by William D. Callister, Jr., David G. Rethwish (z-lib.org).pdf
3.	
MOOC	
1.	Top Material Science Courses - Learn Material Science Online
2.	my-mooc.com/en/mooc/materials-science-and-engineering-879478d1-3c39-4d3f-9e0e-eafab5ed91e0

COURSE TITLE	**ANALYTICAL CHEMISTRY**			**CREDITS**	**3**
COURSE CODE	**BCT01502**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	**This course involves learning the principles of identifying and quantifying the chemical composition of matter using both classical and modern instrumental techniques.**
Course Objective	1. Acquiring knowledge of classical and instrumental methods. 2. Applying statistical methods to analyze and interpret data. 3. Performing both qualitative and quantitative analysis 4. Mastering techniques for separation, identification, and quantification of chemical substances
Course Outcome	Upon completion of this course, the students will be able to 1. analyze the experimental data. 2. estimate cations by gravimetry. 3. determine the ions by volumetry. 4. calculate the given sample by instrumental methods.

	5. separate chemicals.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: ERRORS IN MEASUREMENT	**(6L+3T)**
Statistical tests and Error Analysis: Accuracy, precision, classification of errors- minimization of errors- significant figures and computation- mean deviation and standard deviation- Gaussian distribution- the value of statistics-Sampling and sample treatment- Factors involved in effective sampling-good samples- representative and homogeneous- the binomial distribution- samples of mixtures- physical separations in sample preparation- samples of mixtures- pre-concentration and pre-dilution.	**CO-1 BTL-3**
MODULE 2: GRAVIMETRY	**(6L+3T)**
Theory of gravimetric analysis -Introduction, solubility, solubility product- common ion effect, precipitation methods - the colloidal state - super saturation - precipitate formation- co- precipitation- condition of precipitation-precipitation from homogeneous solution-purity of precipitates- Washing of precipitates-ignition of precipitates- thermo-gravimetric analysis and contamination of precipitates.	**CO-2 BTL-3**
MODULE 3: TITRIMETRY	**(6L+3T)**
Acid Base titrations: Classification-theory of acid-base titration- naturalization indicators- mixed indicators – universal indicators - neuturalization curves - choice of indicators in naturalization reactions. Complexometric titrations: Stability of complexes – factors influencing the stability of complexes- stability constants of EDTA complexes- titration curves- selectivity- masking and demasking agents- metal ion indicators. Precipitation titrations: Theory of precipitation reactions - determination of end point in precipitation reactions.	**CO-3 BTL-3**

Oxidation -reduction titration: Theory- change of electrode potential during the titration of a reductant with an oxidant-formal potentials-detection of end points in oxidation - reduction titrations- titrations in non - aqueous media.	
MODULE 4: COLORIMETRY & SPECTROPHOTOMETRY	**(6L+3T)**
Standard series method - duplication method - balancing method - photoelectric colorimeter - spectrophotometer – single beam- double beam - determination of pKa value of an indicator- simultaneous spectrophotometric determination. Flame spectrometry: Instrumentation, combustion flames - nebuliser burner system- resonance line sources – monochromator - detector – types of interferences –comparison - single beam AAS - double beam AAS non flame techniques - cold vapour AAS.	**CO-4** **BTL-3**
MODULE 5: SEPARATION TECHNIQUES	**(6L+3T)**
Chromatography: Principles- classification- Techniques of column chromatography- ion exchange chromatography- gas chromatography- High performance liquid chromatography- paper chromatography and thin layer chromatography. Solvent extraction: Distribution coefficient- distribution ratio- solvent extraction of metals- analytical separations- multiple batch extractions- countercurrent distribution	**CO-5** BTL-3

BOOKS	
1.	D.A. Skoog, D.M. West, F.J Holler, S.R Crouch, “Fundamentals of Analytical Chemistry”, 8th edition, Thomson Brooks Cole, 2014
2.	Gary D. Christian, “Analytical Chemistry”, 5th Edition, John-Wiley & Sons, Inc, 2018.
REFERENCE BOOKS	
1	B.K.Sharma, “Instrumental Methods of Chemical Analysis”, Krishna Prakashan Media (p) Ltd, 2007.
2	D. A. Skoog & D. M. West, “Principles of Instrumental Analysis”, Holt Reinhart Winston, 1988.
3	K. A. Robinsons, “Chemical Analysis”, Harper Collins Publishers, 1987.
4	J. Basset, R. C. Denny, C. H. Jaffery and J. Mendhan, “Vogel’s Text Book of quantitative Inorganic Analysis”, 5th Edition, ELBS, 1989.
E Resources for Reference	
1.	Analytical Chemistry 2.1 - Open Textbook Library
2.	kvmwai.edu.in/upload/StudyMaterial/Analytical-Chemistry-by-Gary-D_-Christian-Purnendu-K_-Dasgupta-Kevin-A_-Schug-z-lib_org_.pdf
3.	
MOOC	
1.	Analytical chemistry - Course
2.	Basic Analytical Chemistry | My Mooc

COURSE TITLE	POLYMER CHEMISTRY			CREDITS	3
COURSE CODE	BCT01503	COURSE CATEGORY	DE	L-T-P-S	2-1-0-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance*	
15%	15%	10%	5%	5%	50%

Course Description	**This covers the fundamental principles of synthesizing, characterizing, and analyzing polymers, which are large molecules composed of repeating structural units.**
Course Objective	1. To Provide a comprehensive understanding of polymers. 2. Their synthesis, structure, and properties, and their applications in various fields. 3. Students will learn how to characterize polymers. 4. Understand the relationship between their structure and properties, and apply this knowledge to design and process materials for specific uses.
Course Outcome	Upon completion of this course, the students will be able to 1. Compare various polymerization methods. 2. Able to design suitable catalyst for stereo specific polymers. 3. Suggest suitable polymerization techniques. 4. Determine properties of polymers. 5. Prepare open ended polymers.

Prerequisites: Knowledge in physical and organic chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related	
MODULE 1: INTRODUCTION TO POLYMERS	**(6L+3T)**
Polymers and macromolecules –Monomers, Homo, Hetero and Co-polymers - Classification - Natural and synthetic polymers - Organic and inorganic polymers - Linear, Branched and cross-linked polymers - Plastics, elastomers, fibres and liquid resins; Thermoplastics and thermosetting plastics (Basic idea only) Dendrimers (Basic idea only) Isomerism of Polymers Structural and stereoisomerism Tacticity in polymers- atactic, isotactic and syndiotactic polymers	**CO-1 BTL-3**
MODULE 2: TYPES OF POLYMERIZATION	**(6L+3T)**
Addition polymerisation-Chain polymerisation- free radical polymerization; Ionic, Coordination polymerisation with mechanism; Zegler Natta polymerisation with mechanism and its advantages. Condensation Polymerisation-Step Growth Polymerisation-(Mechanism); Ring Opening-(Mechanism) and Group transfer polymerization (mechanism not needed)	**CO-2 BTL-3**
MODULE 3: POLYMERISATION TECHNIQUES	**(6L+3T)**
Bulk, Solution, Suspension, Emulsion, Melt Condensation and Interfacial Polycondensation Techniques.	**CO-3 BTL-3**
MODULE 4: PROPERTIES OF POLYMERS	**(6L+3T)**
Molecular weights of polymers- Average molecular weights -Number average, Weight average. Sedimentation average (Method of determination not required) and Viscosity average molecular weight (method of determination not required); Poly dispersity index and molecular weight distribution (mention only) ; Molecular weight and Degree of polymerization; Glass transition temperature –definition, factors affecting Tg, importance of Tg (brief discussion)	**CO-4 BTL-3**
MODULE 5: PREPARATION OF POLYMERS	**(6L+3T)**
Preparation of nylon -6,6 (Interfacial polycondensation) ; Preparation of PMMA (free radical bulk polymerization) ; Preparation of phenol formaldehyde resin (resoles and novolacs) ; Preparation of urea formaldehyde resin ; Preparation of polyaniline	**CO-5** BTL-3

BOOKS	
1.	F. W. Billmeyer Jr., “Textbook of Polymer Science”, John Wiley and Sons, New Delhi, 2017.
2.	V. R. Gowarikar, “Polymer Chemistry”, New Age International Pvt. Ltd., New Delhi, 2010
REFERENCE BOOKS	
1	George Odian, “Principles of Polymerization”, 4th Edn., Wiley, 2004 .
2	M. G. Arora, M. Singh, M. S. Yadav, “Polymer Chemistry”, 2nd Revised Edition, Anmol Publications Private Ltd., New Delhi, 1989.
3	E.A. Collins, J. Bares, F.W. Billmeyer, “Experiments in Polymer Science”, Wiley- Inter science, 1973.
4	S.H. Pinner, “A Practical Course in Polymer Chemistry”, Pergamon, 1961.
E Resources for Reference	
1.	Polymer Fundamentals - Chemistry LibreTexts
2.	Polymer Chemistry, Sixth Edition
3.	
MOOC	
1.	Processing of Polymers and Polymer Composites - Course
2.	Polymers MOOC and Free Online Courses | MOOC List

COURSE TITLE	SURFACE AND COLLOIDAL CHEMISTRY			CREDITS	3
COURSE CODE	BCT01504	COURSE CATEGORY	DE	L-T-P-S	2-1-0-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance*	
15%	15%	10%	5%	5%	50%

Course Description	**This explores the behavior of substances at interfaces and within colloidal systems (1-1000 nm particles), covering topics like adsorption, surface tension, and the properties of dispersions, emulsions, foams, and gels.**
Course Objective	1. To understand the fundamental principles of interfacial phenomena and colloidal systems. 2. To analyze the properties, and applying these concepts to real-world applications in industry. 3. To learn about topics like surface tension, adsorption, colloidal interactions 4. To characterize the micellar systems.
Course Outcome	Upon completion of this course, the students will be able to 1. To identify adsorption isotherms. 2. To compare Langmuir, BET and other isotherms. 3. To suggest preparation methods of colloids. 4. To characterize the colloids using instruments. 5. To deduce the structure of micelles and to find CMC.

Prerequisites: Knowledge in physical chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

CO-5	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO SURFACE CHEMISTRY	**(6L+3T)**
Adsorption by solids – Chemisorption, physisorption, applications of adsorption, adsorption of gases by solids, factors influencing adsorption.	**CO-1** **BTL-3**
MODULE 2: ADSORPTION ISOTHERMS	**(6L+3T)**
The Freundlich adsorption isotherm, The Langmuir theory of adsorption, The BET theory of multilayer adsorption. Deviation of BET equation. Types of adsorption isotherms. Adsorption from solution – The Gibbs adsorption isotherm.	**CO-2** **BTL-3**
MODULE 3: THE COLLIDAL STATE	**(6L+3T)**
The Colloidal system – Preparation of lyophobic colloidal solution by dispersion and condensation methods – Purification of colloidal systems, properties of colloidal systems and properties of hydrophobic colloids.	**CO-3** **BTL-3**
MODULE 4: PROPERTIES OF COLLOIDS	**(6L+3T)**
Electrical properties – Charge on colloidal particles, the electrical double layer, DLVO theory of stability of lyophobic colloids, coagulation of colloidal solutions. Electrokinetic properties – Electrophoresis, Electro-osmosis. Determination of size of colloidal particles.	**CO-4** **BTL-3**
MODULE 5: SURFACTANTS	**(6L+3T)**
Surface-active agents, hydrophile-Lipophile balance, Micelle formation – The mass action model and the phase separation model, shape and structure of micelles, micellar aggregation numbers, critical micelle concentration, factors affecting CMC in aquesous media.	**CO-5** BTL-3

BOOKS	
1.	Puri Sharma, Pathania, “Principles of Physical Chemistry”, Vishal Publishing Co., 49th edition, 2025.
2.	Atkins, “Physical Chemistry” 2018.
REFERENCE BOOKS	
1	Paul C. Hiemenz, Raj Rajagopalan, “Principles of Colloid and Surface Chemistry”, 1997.
2	Marcel Dekker, “Principles of colloid and surface chemistry”, 2021.
3	K. S. Birdi, “Handbook of Surface and Colloid Chemistry”, 4th Edi., CRC Press, 2016.
4	
E Resources for Reference	
1.	chemistlibrary.wordpress.com/wp-content/uploads/2015/02/principals-of-colloid-and-surface-chem.pdf
2.	https://onlinelibrary.wiley.com/doi/book/10.1002/9781118881194
3.	
MOOC	
1.	Colloids and Surfaces - Course
2.	50+ Surface Chemistry Online Courses for 2025 | Explore Free Courses & Certifications | Class Central

COURSE TITLE	QUANTUM CHEMISTRY			CREDITS	3
COURSE CODE	BCT01505	COURSE CATEGORY	DE	L-T-P-S	2-1-0-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance*	
15%	15%	10%	5%	5%	50%

Course Description	**This course describes the application of quantum mechanics to understand chemical systems, covering topics like the electronic structure of atoms and molecules, molecular properties, and chemical reactions from an atomic perspective.**
Course Objective	1. This course aims to introduce fundamental concepts of quantum mechanics 2. To explain the structure, properties, and reactivity of atoms and molecules. 3. Key objectives include learning to apply quantum theory 5. Understanding concepts like the Schrödinger equation, quantum numbers, and bonding 6. Gaining knowledge of spectroscopy and computational methods.
Course Outcome	Upon completion of this course, the students will be able to 1. explain various stages in the development of quantum chemistry. 2. find the significance of the wave function. 3. compare VB and MO theories. 4. explain the bonding in polyatomic molecules. 5. plot wave function of a particle in box

Prerequisites: Knowledge in general chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related	
MODULE 1: THE QUANTUM REVOLUTION AND ITS EARLY IMPACT IN ATOMIC STRUCTURE	**(6L+3T)**
Experiments which led to the development and generalization of quantum theory – black body radiation, Planck's quantum hypothesis, photoelectric effect, Einstein's generalization of quantum theory; Atomic model partly based on quantum theory – Bohr's theory of the atom, calculation of Bohr radius, velocity and energy of an electron.	**CO-1** **BTL-3**
MODULE 2: INTRODUCTORY QUANTUM CHEMISTRY AND THE QUANTUM MECHANICAL MODEL OF THE ATOM	**(6L+3T)**
Heisenberg's uncertainty principle and the need of quantum mechanics for the micro world; Postulates of quantum mechanics - Wave function postulate, Physical significance of the wave function, The Born interpretation of the wave function and probability density. Well behaved functions, orthonormal functions	**CO-2** **BTL-3**
MODULE 3: BONDING IN DIATOMIC MOLECULES	**(6L+3T)**
Hamiltonian operator of H_2 molecule - Born-Oppenheimer approximation, approximate theories of chemical bonding. Molecular orbital theory of H_2 molecule –linear combination of atomic orbitals (LCAO). Comparison of VB and MO theories.	**CO-3** **BTL-3**
MODULE 4: BONDING IN POLYATOMIC MOLECULES	**(6L+3T)**
Concept of Hybridization: Need of hybridization, Definition (mixing of wave functions of the same atom). LCAO of the central atom – coefficients of atomic orbitals in the linear combination of sp (BeH_2), sp^2 (BH_3) and sp^3 (CH_4) hybridization (derivation not required).	**CO-4** **BTL-3**
MODULE 5: OPEN ENDED MODULE: LEARNING THROUGH PROBLEM SOLVING AND PLOTS	**(3L+3T)**
Plots of wave functions of particle in a box using excel or other software ; Plots of angular parts of atomic orbitals using any freeware ; Problem solving sections ; Connections with inorganic chemistry topics.	**CO-5** BTL-3

BOOKS	
1.	D. A. McQuarrie, J. D. Simon, "Physical Chemistry – A Molecular Approach", 2001.
2.	I. N. Levine, "Quantum Chemistry", Pearson Education Inc., 6th Edi., 2009.
REFERENCE BOOKS	
1	James E. Huheey, Ellan A. Keiter, Richard L. Keiter, "Inorganic Chemistry – Principles of Structure and Reactivity", Harper Collins, 4th Edi., 1993.
2	D. A. McQuarrie, J. D. Simon, "Physical Chemistry – A Molecular Approach", Viva, 2001.
3	F.L. Pilar, "Elementary Quantum Chemistry", Dover, 2nd Edi., 1990.
4	P. W. Atkins, R. S. Friedman, "Molecular Quantum Mechanics", Oxford University Press, 4th Edi., 2005.
E Resources for Reference	
1.	Quantum Chemistry - Chemistry LibreTexts
2.	Quantum Chemistry – Indian Institute Of Technology Goa
3.	
MOOC	
1.	Quantum Chemistry of Atoms and Molecules - Course
2.	Quantum Chemistry MOOC and Free Online Courses | MOOC List

COURSE TITLE	GREEN CHEMISTRY			CREDITS	3
COURSE CODE	BCT01506	COURSE CATEGORY	DE	L-T-P-S	2-1-0-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance*	
15%	15%	10%	5%	5%	50%

Course Description	**This course involves learning the principles of designing and implementing chemical products and processes that reduce or eliminate the use and generation of hazardous substances.**
Course Objective	1. To Understanding and applying the principles of waste prevention, designing safer chemicals and processes 2. To create sustainable products and reduce environmental impact. 3. To evaluate the environmental footprint of chemical processes 4. To explore alternative synthesis methods and solvents.
Course Outcome	Upon completion of this course, the students will be able to 1. suggest green chemical methods of preparation 2. design green chemical processes 3. identify cleaner production methods for chemicals 4. derive strategies for sustainable development 5. conduct environment friendly photodegradation

Prerequisites: Knowledge in fundamentals of organic chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

CO-4	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-5	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO GREEN CHEMISTRY	**(6L+3T)**
What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/Obstacles in the pursuit of the goals of Green Chemistry. Definition and concepts: green chemistry; sustainable consumption of resources; individual and community level participation such as small-scale composting pits for biodegradable waste.	**CO-1** **BTL-3**
MODULE 2: PRINCIPLES OF GREEN CHEMISTRY AND DESIGNING A CHEMICAL SYNTHESIS	**(6L+3T)**
Twelve principles of Green Chemistry with their explanations and examples; 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).	**CO-2** **BTL-3**
MODULE 3: CLEANER PRODUCTION	**(6L+3T)**
The Cleaner Production Concept, Why Cleaner Production, Difference with End of Pipe Concept, Cleaner Production and Sustainable Development, Implementation of Cleaner Production, Change of Raw Material, Technology Change, Good Operating Practice, Product Change, On Site Reuse and Recycling, Who Is Responsible for Cleaner Production, Government Rules, Green Synthesis of Nano Particles.	**CO-3** **BTL-3**
MODULE 4: GREEN CHEMICAL STRATEGIES FOR SUSTAINABLE DEVELOPMENT	**(6L+3T)**
Areas of green chemistry, Reaction mass balance-Atom Economy, Evaluation for Chemical Reaction Efficiency, Green Solvents/ reaction Media, Catalysis and Bio catalysis. Microwave oven as a reactor, Theory of Microwave Heating.	**CO-4** **BTL-3**
MODULE 5: PHOTOCHEMICAL DEGRADATION: AN ECO-FRIENDLY APPROACH OF WASTE TREATMENT	**(6L+3T)**
Photochemical Degradation: An Eco-friendly Approach of Waste Treatment Photochemical Principles, Heterogeneous Photo-catalysis, Homogeneous Photo-degradation, photo oxidation, Direct Photo-degradation, Gas phase Detoxification, Equipment and applications.	**CO-5** BTL-3

BOOKS	
1.	Mukesh Doble, Anil Kumar Kruthiventi, “Green Chemistry and Engineering”, 2017.
2.	V.K. Ahluwalia and M.R. Kidwai, “New Trends in Green Chemistry”, Anamalaya Publishers, 2015.
REFERENCE BOOKS	
1	Albert Matlack, “Introduction to Green Chemistry”, 3rd Edition, 2022.
2	Stanley E. Manahan, “Green Chemistry and the Ten Commandments of Sustainability”, ChemChar Research Inc., 2005.
3	l. T. Sidhwani, R. K. Sharma, “An Introductory Text on Green Chemistry”, 2020.
4	
E Resources for Reference	
1.	Basics of Green Chemistry | US EPA
2.	Green Chemistry Resources - CHM 351: Green Chemistry Technologies - Research Guides at Wake Forest University
3.	Green and Sustainable Chemistry - eCourse | UNEP - UN Environment Programme
MOOC	

1.	Green Chemistry MOOC and Free Online Courses | MOOC List
2.	my-mooc.com/en/categorie/chemistry

COURSE TITLE	NANOCHEMISTRY			CREDITS	3
COURSE CODE	BCT01507	COURSE CATEGORY	DE	L-T-P-S	2-1-0-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance*	
15%	15%	10%	5%	5%	50%

Course Description	**This course covers the synthesis, characterization, properties, and applications of materials at the nanoscale (1-100 nm). Topics include the history and basic concepts of nanochemistry, methods for preparing nanostructures like carbon nanotubes and nanoparticles.**
Course Objective	1. To synthesis, characterization, properties, and applications of materials at the nanoscale (1-100 nm). 2. To understand the history and basic concepts of nanochemistry. 3. To prepare nanostructures like carbon nanotubes and nanoparticles.
Course Outcome	Upon completion of this course, the students will be able 1. To suggest suitable methods of nanomaterials preparation 2. To characterize nanomaterials 3. To apply nanomaterials in various fields 4. To control air, water and soil pollution 5. To design a nanocomposite

Prerequisites: Knowledge in fundamentals of chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

CO-3	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-4	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-5	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: BASIC CONCEPTS OF NANOCHEMISTRY	**(6L+3T)**
Introduction to Nanoscience; History and Scope, Interdisciplinary nature, Structure of nanomaterials, general properties of bulk materials and nanomaterials, Methods of synthesis-Top down and Bottom-up approaches, Chemical methods of synthesis & advantages-Sol-gel, Co-precipitation Solution combustion methods, Chemical vapor deposition method and Spray pyrolysis.	**CO-1** **BTL-3**
MODULE 2: CHARACTERIZATION OF NANOMATERIALS	**(6L+3T)**
Principle, instrumentation and applications of Powder X-ray diffraction, Fourier transform infrared spectroscopy, UV-Vis spectroscopy, Scanning electron microscopy, transmission electron microscopy, Thermal gravimetric analysis, Energy dispersive spectroscopy and BET-analysis.	**CO-2** **BTL-3**
MODULE 3: NANOMATERIALS FOR GREEN SYSTEMS	**(6L+3T)**
Green materials, including biomaterials, biopolymers, bioplastics, and composites Nanotech Materials for Truly Sustainable Construction: Windows, Skylights, and Lighting. Paints, Roofs, Walls, and Cooling. Multifunctional Gas Sensors, Biomimetic Sensors, Optical Interference Sensors Thermo-, light-, and stimulus-responsive smart materials.	**CO-3** **BTL-3**
MODULE 4: NANOTECHNOLOGY and ITS APPLICATIONS	**(6L+3T)**
Introduction, materials used and applications in renewable energy generation, drug delivery, cosmetics, tissue engineering, bioinformatics, information technology, agriculture & food technology, high integrated circuits, nanomedicine, molecular motors, bioelectronics & spintronics, Fuel cells, Photocatalytic hydrogen generation. Water remediation-Photocatalytic degradation of toxic dyes, Photocatalytic reduction of Cr6+ to Cr3+, Defluorination of water. Electrochemical sensor, Biosensors, Textiles & Cosmetics, Defense & Aerospace.	**CO-4** **BTL-3**
MODULE 5: NANOCOMPOSITES	**(6L+3T)**
Introduction, Doping technique, binary and ternary nanocomposites, synthesis, properties and applications of metal-metal oxide and metal oxide-metal oxide nanocomposites, Biodegradable polymer-based nanocomposites, Ternary epoxy nanocomposite systems, glass-metal nanocomposites, nanocomposites from biomaterials, thermoplastic-based nanocomposites, Nylon-6 nanocomposites, Clay polymer nanocomposites.	**CO-5** BTL-3

BOOKS

1.	A. K. Bandyopadhyay, "Nanomaterials", New Age International (P) Ltd., 2nd Edi., 2010.
2.	N. Kumar, "Concise concepts of nanoscience and nanomaterials", Scientific publishers, 2018.

REFERENCE BOOKS

1	Geoffrey A. Ozin, Andre C. Arsenault, "Nanochemistry: A Chemical Approach to Nanomaterials", 2009.
2	Anna Klinkova, Héloïse Thérien-Aubin, "Nanochemistry - Chemistry of Nanoparticle Formation and Interactions", 1st Edition, 2023.
3	Klinkova & Thérien-Aubin, "Nanochemistry: Chemistry of Nanoparticle Formation and Interactions", Elsevier, 2023.
4	

E Resources for Reference	
1.	https://www.youtube.com/results?search_query=Characterization+of+Nanomaterials 2.
2.	https://www.youtube.com/watch?v=qUEbxTkPIWI&list=PLbMVogVj5nJSl_2XmFjuRmvuAgCOZXUjv 3.
3.	https://www.youtube.com/watch?v=qUEbxTkPIWI 4. https://www.youtube.com/watch?v=4j5cMHVPStc
MOOC	
1.	my-mooc.com/en/categorie/nanotechnology
2.	CHEMISTRY OF NANOMATERIALS - Course

COURSE TITLE	**ORGANOMETALLIC CHEMISTRY**			**CREDITS**	**3**
COURSE CODE	**BCT01508**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	**This course introduces the fundamental principles of compounds with metal-carbon bonds, covering their synthesis, structure, bonding, and reactivity.**				
Course Objective	1. Understanding the synthesis, bonding, structure, and reactivity of organometallic compounds 2. Learning fundamental reactions like oxidative addition and reductive elimination 3. Exploring their applications in catalysis and organic synthesis 4. Understand how these compounds are used in industry				
Course Outcome	Upon completion of this course, the students will be able to 1. suggest suitable transition metal ions for organic transformations 2. identify use of metal carbonyls in organic synthesis 3. design palladium organochemicals for reactions 4. explore free radical reactions of organoboranes and organosilanes 5. suggest suitable catalyst for important industrial reactions				
Prerequisites: Knowledge in inorganic chemistry.					

CO, PO AND PSO MAPPING															
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-2	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-3	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-4	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-5	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: TRANSITION METAL CHEMISTRY FOR ORGANIC SYNTHETIC TRANSFORMATIONS	**(6L+3T)**
Metal carbenes – synthesis – reactivity - analogy with ester groups for oxy carbenes - cycloaddition reactions of metal carbenes - synthesis of fused ring systems - Dotz reaction - mechanism of ring formation - application in targeted organic synthesis	**CO-1** **BTL-3**
MODULE 2: METAL CARBONYLS IN ORGANIC SYNTHESIS	**(6L+3T)**
Pearson reaction - use of organoiron complexes for stereospecific synthesis of substituted cyclic compounds - Use of arene chromium tricarbonyl complexes in organic synthesis - the stereo effect of piano-stool structure	**CO-2** **BTL-3**
MODULE 3: PALLADIUM IN ORGANIC SYNTHESIS	**(6L+3T)**
Addition of organopalladium to unsaturated compounds - application to organic synthesis - stereochemical implications - Heck reaction - applications in synthesis	**CO-3** **BTL-3**
MODULE 4: ORGANOBORANES AND ORGANOSILANES IN ORGANIC SYNTHESIS	**(6L+3T)**
Hydroboration – reactions of organoboranes – enantio selecvitive synthesis of secondary alcohols from alkenes – reaction with α – bromoketones – diazo compounds - free radical reactions of organoboranes – protection of functional groups with organosilicon compounds	**CO-4** **BTL-3**
MODULE 5: METALLOCENES	**(6L+3T)**
Metallocenes - Ziegler-Natta polymerization of alkenes with stereospecificity - Hydroformylation, Wacker process - oxo process – hydrogenation - oxidation - other catalytic processes	**CO-5** BTL-3

BOOKS	
1.	Stephen G. Davies, "Organotransition Metal Chemistry - Application to Organic Synthesis", Pergamon Press, 2012.
2.	J. P. Collman, L. S. Hegedus, J. R. Norton, and R. G. Finke, "Principles and Applications of Organotransition Metal Chemistry", University Science Books, 2018.
REFERENCE BOOKS	
1	Barry Trost and Ian Fleming, "Comprehensive Organic Synthesis", Pergamon, 1996.
2	Wilkinson, "Comprehensive Organometallic Chemistry", Pergamon, 1982.
3	W. Carruthers, "Some Modern Methods of Organic Synthesis", Cambridge University Press, 3rd Edi., 1986.
4	
E Resources for Reference	
1.	Textbooks & References - CHEM 422 - Organometallic Chemistry - LibGuides at University of Rochester
2.	Organometallic Chemistry – Courseware :: Centurion University
3.	The Organometallic HyperTextBook: Index

MOOC	
1.	Organometallic Catalysis in Sustainable Chemistry | Coursera
2.	Transition Metal Organometallic Chemistry: Principles to Applications - Course

COURSE TITLE	INDUSTRIAL CHEMISTRY			CREDITS	3
COURSE CODE	BCT01509	COURSE CATEGORY	DE	L-T-P-S	2-1-0-0
Version	0.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance*	
15%	15%	10%	5%	5%	50%

Course Description	**This course focuses on applying chemical principles to transform raw materials into useful products for various industries.**
Course Objective	1. The main objectives of an industrial chemistry course are to equip students with the knowledge and skills in industrial chemistry. 2. To apply chemical principles in manufacturing and production 3. Understand industrial processes 4. Prepare them for careers in various chemical industries
Course Outcome	Upon completion of this course, the students will be able to 1. Students will be above to suggest suitable chemical techniques used in industries 2. Students will be able to apply manufacturing techniques in organic chemicals. 3. Students will be able to compare petroleum fuels and their properties. 4. Students will be able to analyze properties of oil and fats. 5. Students can determine the properties of glasses and cement.

Prerequisites: Knowledge in general chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3

CO-1	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-2	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-3	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-4	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**
CO-5	**3**	**1**	**2**	**3**	**3**	**-**	**2**	**1**	**1**	**-**	**1**	**3**	**3**	**2**	**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: CHEMICAL TECHNOLOGY	**(6L+3T)**
Basic principles of distillation, solvent extraction, solid-liquid leaching and liquid-liquid extraction, separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills. Introduction to clean technology.	**CO-1** **BTL-3**
MODULE 2: INORGANIC CHEMICALS	**(6L+3T)**
Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.	**CO-2** **BTL-3**
MODULE 3: FUEL CHEMISTRY	**(6L+3T)**
Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.	**CO-3** **BTL-3**
MODULE 4: OILS AND FATS	**(6L+3T)**
Classification of oils, fat splitting, distillation of completely miscible and non-miscible oils, hydrogenation of oils, rancidity, saponification value, iodine number, acid value, Soap and Synthetic Detergent, preparation of soap and detergent, different types of soap and their composition, surfactants (LAS, ABS, LABS), detergent binders and builders	**CO-4** **BTL-3**
MODULE 5: SILICATE INDUSTRIES	**(6L+3T)**
Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass. Cements : Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements	**CO-5** BTL-3

BOOKS

1.	Rose Philo K.J and Joyes Jacob, “Industrial Chemicals and Environment”, 2019.
2.	Farooqui Maqdoom, “A Textbook of Industrial Chemistry”, 2016.

REFERENCE BOOKS

1	Krishna Prakashan, B K Sharma, “Industrial Chemistry” PART 1 & 2, 2023.
2	Kent J.A., Riegel’s Handbook of Industrial Chemistry”, 9th Edi., 1997.
3	Dr. V Mohan Goud, Dr. Nagaraju Potnuri, Dr. Martha Srinivas, “Basics of Industrial Chemistry, Pharmaceuticals, Polymers, and Business”, Notion Press, 2022.
4	
E Resources for Reference	
1.	oldsite.msdsu.ac.in/download/Industrial-chemistry (1).pdf
2.	cbspd.com/product/handbook-of-industrial-chemistry-vol-1-9788123910567?srsltid=AfmBOoppkdoMAMn21my7tmR8Bh5q6PeeSzYL48LR9MqoBLHFKZsb5991
3.	
MOOC	
1.	Industrial Inorganic Chemistry - Course
2.	Industrial Chemical Technology

COURSE TITLE	**ELECTROCHEMISTRY**			**CREDITS**	**3**
COURSE CODE	**BCT01510**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-1-0-0**
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee “DEC””**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	**This course typically covers the fundamental principles connecting chemical reactions and electricity, including thermodynamics, kinetics, and electrochemical cells.**
Course Objective	1. Understanding fundamental principles of electrochemical cells, thermodynamics, and kinetics 2. Apply these theories to solve problems in areas like energy storage, materials synthesis, etc. 3. Students will gain knowledge of electrode processes 4. The behavior of ions in solution, and to design experiments
Course Outcome	Upon completion of this course, the students will be able to 1. determine equivalent conductance at infinite dilution for weak electrolyte 2. identify the type of the given cell

	3. analyze the type of corrosion 4. suggest suitable method to prevent corrosion 5. apply the principle of electrochemistry in storage of electricity.

Prerequisites: Knowledge in physical chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO ELECTROCHEMISTRY	**(6L+3T)**
Introduction, Conductance-Specific, Equivalent and Molar conductance, Effect of dilution on electrolytic conductance. Kohlrausch Law, determination of equivalent conductance at infinite dilution for weak electrolytes. Conductometric titrations.	**CO-1** **BTL-3**
MODULE 2: TYPES OF CELLS	**(6L+3T)**
EMF series, experimental determination, applications. Development of electrode potential, types of electrodes, Calomel Quinhydrone and Glass electrodes. Galvanic Cells, Nernst equation, simple problems, concentration cells, decomposition potential, over voltage.	**CO-2** **BTL-3**
MODULE 3: CORROSION	**(6L+3T)**
Definition – examples – driving force – types of corrosion – Dry corrosion and Wet corrosion – mechanism. Galvanic corrosion – concentration cell corrosion – different types, galvanic series, factors influencing corrosion – metal – environment.	**CO-3** **BTL-3**
MODULE 4: CORROSION CONTROL	**(6L+3T)**
Corrosion control – design – Sacrificial anodic protection, impressed current cathodic protection, protective coatings – metallic coatings – electroplating, electroless plating, diffusion coatings – Non-metallic coatings – Paints – constituents of paint, preparation of substrate and application method – Varnish – Lacquers – Enamels.	**CO-4** **BTL-3**
MODULE 5: BATTERIES	**(6L+3T)**
Primary cells – Leclanche cell – alkaline battery - Secondary cells – nickel-cadmium battery, nickel metal hydride battery, lead-acid battery. Fuel cells – different types - Hydrogen – Oxygen fuel cell, SOFC, advantages and applications – Solar cell – mechanism.	**CO-5** BTL-3

BOOKS

1.	Samuel Glasstone, “An Introduction to Electrochemistry”, 2006.
2.	S.A. Iqbal, “Textbook of Electrochemistry”, 2011.

REFERENCE BOOKS

1	Allen J. Bard, Larry R. Faulkner, Henry S. White, "Electrochemical Methods: Fundamentals and Applications", John Wiley & Sons, 3rd Edi., 2022.
2	Rudolf Holze, "Experimental Electrochemistry: A Laboratory Textbook", 2nd Edi., 2019.
3	Bockris J, Modern Electrochemistry – Vol 1- Ionics, Springer, 2nd Edi., 2018.
4	
E Resources for Reference	
1.	Fundamentals_of_electrochemistry_2ed_2006_-_Bagotsky.pdf
2.	users.encs.concordia.ca/~tmg/images/9/9d/Fundamentals_of_Electrochemistry_2nd_Ed.pdf
3.	
MOOC	
1.	Electrochemistry MOOC and Free Online Courses | MOOC List
2.	Electrochemistry : Foundations | My Mooc

COURSE TITLE	**NUCLEAR CHEMISTRY**			**CREDITS**	**3**
COURSE CODE	**BCT01511**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	
Version	**0.0**	**Approval Details**		**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	**This course describes the study of the atomic nucleus, its properties, and the transformations it undergoes through processes like radioactive decay, fission, and fusion.**				
Course Objective	1. Understanding nuclear reactions, radioactive decay, and radiation detection 2. Applications of radioisotopes in medicine, industry, and environmental studies. 3. Understand radiation safety and protection 4. Learn about nuclear energy and waste management.				
Course Outcome	Upon completion of this course, the students will be able to 1. differentiate isotopes, isobars and similar terminologies 2. calculate half-life period of radio decay 3. calculate mass balance in nuclear reactions				

	4. suggest safe working methods 5. separate nuclear isotopes using chemical methods

Prerequisites: Knowledge in inorganic chemistry.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-2	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-3	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-4	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3
CO-5	3	1	2	3	3	-	2	1	1	-	1	3	3	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: THE NUCLEUS	**(6L+3T)**
The subatomic particles: electron, proton, neutron, antiproton, positron, meson, quacks - Mass of nuclei: isotopes, isobars, mass spectrometry- identification of isotopes-Radius of atomic nuclei-binding energy of nuclei-force between nucleons- nuclear moment nuclear angular momentum, nuclear magnetic dipole moment, electric quadrupole moment – NQR- Nuclear models: liquid drop model, nuclear shell model, fermi gas model.	**CO-1** **BTL-3**
MODULE 2: RADIOCHEMISTRY	**(6L+3T)**
Radioactive series decay: radioactive series growth and decay, determination of half –lives-Alpha decay: theory of emission, alpha-ray energy spectra-Beta-decay: decay theory, electron capture, double beta decay-Gamma ray: theory of emission, internal conversion, the Auger effect, nuclear resonance absorption.	**CO-2** **BTL-3**
MODULE 3: NUCLEAR REACTION	**(6L+3T)**
Types of nuclear reactions: reaction cross section-compound nucleus theory, high energy nuclear, direct nuclear, photonuclear and thermonuclear reactions- Fission: Fission products and Fission yield curve, Fission energy, theory of nuclear fission, nuclear reactor, breeder reactor. Fusion reactions hydrogen bomb and energy of sun.	**CO-3** **BTL-3**
MODULE 4: RADIATION CHEMISTRY	**(6L+3T)**
Interaction of radiation with matter - range of alpha, beta and gamma radiations-neutron through matter-radiation dosimetry- Radiolysis of water - Mechanism-hydrated electron- Radiation safety precaution- Safety standards and safe-working methods- Applications of radioactivity	**CO-4** **BTL-3**
MODULE 5: ANALYTICAL METHOD IN NUCLEAR CHEMISTRY	**(6L+3T)**
Radio isotopes: Co-precipitation, ion-exchange, solvent extraction - as a tracer- Synthesis of labeled compounds (any two), isotopic dilution and radiopharmaceuticals- Neutron activation analysis-positron annihilation and autoradiography-Dating of objects and mechanistic study.	**CO-5** BTL-3

BOOKS

1.	H. J. Arnikar, “Essentials of Nuclear Chemistry”, Wiley Eastern Ltd., New Delhi, 2012.

2.	A.K. Srivatsava and P. Jain, “Essential of nuclear Chemistry”, S. Chand, New Delhi, 2019.
REFERENCE BOOKS	
1	G.R. Choppin, “Radiochemistry and Nuclear chemistry”, 2002.
2	G. Friedlander, J. W. Kennedy, and J. M. Miller, “Nuclear and Radiochemistry”, John Wiley and Sons Inc., Japan 2nd Edition, 1964.
3	R. Gopalan, “Elements of nuclear chemistry”, Sultan Chand, Delhi, 2000.
4	
E Resources for Reference	
1.	Nuclear Chemistry - Chemistry LibreTexts
2.	https://link.springer.com/book/10.1007/978-1-4419-0720-2
3.	21: Nuclear Chemistry - Chemistry LibreTexts
MOOC	
1.	Nuclear and Radiochemistry - Course
2.	Nuclear Chemistry MOOC and Free Online Courses | MOOC List