UPL -University of Sustainable Technology

SRICT Institute of Science & Research

B.Sc. Sem. III

Teaching/Exam Scheme

w.e.f.: 1st April'22

Sr. No.	Course code	Categoryof course	Course title	Hours Per week			Tot. Con. hrs.	Credits	E	M	I	V	Total Marks
				L	T	P							
1	BC2201	Foundation Compulsory	Teaching Language through Literature- I	2	-	-	2	2	70	30	-		100
2	BC2202	Core Course	Chemistry-III	4	-		4	4	70	30			100
3	BC2203	Core Course	Chemistry-IV	4	-		4	4	70	30			100
4	BC2204	Core Course	Chemistry-V	4	0		4	4	70	30			100
5	BC2205	Core Course	Chemistry Practical - I			4	4	2			30	70	100
6	BC2206	Core Course	Physics- III	4		4	8	6	70	30	30	70	200
7	BC2207	Generic Elective	Industrial Organic Chemicals	2	-	-	2	2	70	30	-		100
8	BC2208	Compulsory Elective	Summer Internship	-	-	-	*	1	50	-	-	-	50
			Total	20	0	08	30	25	470	180	60	140	850

Generic Elective	1. Industrial Organic Chemicals 2. Industrial Inorganic Chemicals
Compulsory Elective	Summer Internship

Note:* Summer Internship have 35 hours per semester.

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BACHELOR OF SCIENCE
Course Code: BC2201
Course name: Teaching Language through Literature- I
Semester: III

Type of course: Foundation Compulsory

Prerequisite: Zeal to learn the subject.

Rationale: At the end of the course, students will have knowledge about spoken and written communication. It also targets the understanding of language through speaking and writing skills. This would be developed through balanced and integrated tasks.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	-	-	2	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**Fiction:** ‘David Copperfield’ by Charles Dickens	**06**
2	**Prose:** A Wrong Man in Worker’s Paradise, Toasted English, Grammar of Anarchy.	**04**
3	**Poetry:** Punishment in Kindergarten, As I Grew Older.	**03**
	SECTION-B	
4	**Drama:** ‘Macbeth’ by William Shakespeare	**04**
5	**Prose:** The Gift of the Magi, The Monkey’s Paw, An Astrologer’s Day.	**04**
6	**Poetry:**The Road Not Taken, Daffodils.	**03**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom’s Taxonomy)

Reference Books:

1. TEXT—The Spectrum (Macmillan)
2. William Shakespeare, Macbeth. Maple Classics.
3. Charles Dickens, David Copperfield. Unique Publishers.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Present ideas by reading the literary works and also using various forms of vocabulary	20%
CO-2	Apply the dynamics of various rules of grammar and check its validation through fictional works	20%
CO-3	Relate themselves orally using simple English.	20%
CO-4	Relate to various situations through the fictional presentation of ideas.	10%
CO-5	Using and apprehending the language skills efficiently	20%
CO-6	Understanding the in-depth analysis of language through literature.	10%

List of Open Source Software/learning website:

- http://www.english-online.org.uk/
- http://www.learnenglish.de/

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BACHELOR OF SCIENCE

Course code: BC2202

Course name: Chemistry-III (Inorganic Chemistry)

Semester: III

Type of course: Core Course

Prerequisite: Should have basic knowledge about basic inorganic chemistry and properties of different elements.

Rationale: At the end of the course, students will have knowledge about elemental properties, purification techniques, basic chromatography and quantum chemistry.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	.	.	4	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**CHEMISTRY OF FIRST TRANSITION ELEMENTS** Characteristics properties of d-block elements, properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states.	08
2	**ELECTRONIC CONFIGURATION OF ATOM; L-S COUPLING** Introduction, L-S coupling, J-J coupling (introduction), Term symbol, Determination of microstate of P^2, P^3 system, Term symbol of C, N, O, Ni, Ni^{2+}, Fe, Fe^{2+}, Fe^{+3}, Cr, Cr^{3+}, Co^{2+} , V, V^{3+} and CI.	08
3	**PURIFICATION OF WATER** Classification and composition of water (tap water, mineral water, portable water, distilled water). Different methods of purification of water for potable and industrial purposes, Soft and hard water. Desalination of sea water by reverse osmosis and electro dialysis.	08
	SECTION-B	
4	**PAPER CHROMATOGRAPHY** Principles of chromatography, Classification of chromatography according to mobile phase and stationary phase. Types of paper chromatography, one dimensional, two dimensional and radial paper chromatography, Rr value, Use of paper chromatography in inorganic analysis (I, IIA, IIIB, IV, and halides).	08
5	**QUANTUM MECHANICS - I** Derivation of the time independent Schrodinger equation, Wave function and probability function, Well behaved wave function, Particle in one — dimensional box and its importance.	08

6	**QUANTUM MECHANICS - II** Operators (definition and derivation), Linear operators, Commutator operators, Vector operators, Laplacian operators, Hamiltonian operators, Hermitian operators. Derivation of Hamiltonian equation, Hamiltonian operators for H atom H_2^+, He^{2+} and Li^+.	**08**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Introductory Quantum Chemistry by A. K. Chandra, Tata Mc. Graw Hill Delhi.
2. Theoretical Inorganic Chemistry by M. C. Day & J. Selbin Affiliated, East West Pub. Pvt. Ltd.
3. Coordination Compounds (Studies in Modern Chemistry) S. F. A. Kettle, Nelson.
4. Inorganic Chemistry by (Principles of Structure and Reactivity) James E. Huhely, Harper International (NY).
5. Inorganic Chemistry by R. B. Heslop and P. L. Robinson Elsevier Pub. Co. NY.
6. Physical Methods Inorganic Chemistry by R. S. Drago, W.B.S. Saunders Co. London, Reinhold Pub. Co. NY.
7. Basic Concepts of Analytical Chemistry by S. M. Khopkar, Wiely Estern Ltd. New Delhi.
8. Quantitative Analysis Day & Underwood Prentice Hall of India, Pvt. Ltd.
9. Instrumental Method of Analysis B. K. Sharma, Krishna Pub. House, Merrut.
10. Principles of Inorganic Chemistry (Puri, Sharma, Kalia).
11. Progressive Inorganic Chemistry, Suratkar, Thatte, Pandit, Ideal Book Service, Poona.
12. Advanced Inorganic Chemistry Vol. I & II by Gurudeep Raj, Goel Pub. House, Meerut.
13. Advanced Inorganic Chemistry by Cotton & Wilkinson John Wihn Wiely.
14. Introduction to Chromatography Theory and Practice by V. K. Srivastava and K. K. Srivastava - S. Chand Pub.
15. Inorganic chemistry by Gray L. Miessler, Donald A. Tarr, 3" addition, Pearson publication.
16. General and Inorganic chemistry (part-I & II) by R. Sarkar, Books and Allied (P) Itd.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Enumerate the relative stability of d-block elements.	20%
CO-2	Recognize basic inorganic elements.	20%
CO-3	Develop different methods for water purification	20%
CO-4	Determination of various chemicals by chromatographic techniques.	10%
CO-5	Evaluate Schrodinger equation and its significance	20%
CO-6	Originate different quantum operators	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/

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BACHELOR OF SCIENCE
Course code: BC2203
Course name: Chemistry-IV (Organic Chemistry)
Semester: III

Type of course: Core Course

Prerequisite: Should have basic knowledge about elemental organic compounds, heterocyclic compounds and carboxylic acids.

Rationale: At the end of the course, students will have knowledge about properties, synthesis and reactions about various organic compounds.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**ORGANIC NITROGEN COMPOUNDS** (i) Structure, nomenclature, preparation and properties of organic nitro compounds. (ii) Structure and nomenclature of amines, Preparation of aryl amines, physical properties and chemical reactions. Gabriel-phthalimide reaction, Bromamide reaction. (iii) Preparation and physical properties and chemical reactions of Nitriles, Isonitriles, Carbamates, Semicarbazides and their application in organic synthesis	**08**
2	**CARBOXYLIC ACID AND ITS DERIVATIVES** Structure and nomenclature of carboxylic acid, acid chloride, ester, amides of monocarboxylic acid; Method of formation of carboxylic acid, monocarboxylic acid derivatives and chemical reactions.	**08**
3	**HETEROCYCLIC COMPOUNDS** (i) Classification and nomenclature : (ii) Synthesis, Chemical properties and reactions of aziridine (iii) Synthesis, Chemical properties and reactions of pyridine. (iv) Skraup's synthesis and Friedlander synthesis of quinoline. Electrophilic substitution reactions, Nucleophilic substitution reactions, Oxidation reaction, Reduction reactions. (v) Synthesis, Reactivity and importance of Imidazole and Benzimidazole.	**08**

	SECTION-B	
4	**POLYCYCLIC AROMATIC HYDROCARBONS** (i) Classification and nomenclature : (ii) Linear orthofused polycyclic hydrocarbons: Occurance, synthesis of Tetracene, Pentacene and Hexacene. (iii) Non-linear orthofused polycyclic hydrocarbons: Occurance, synthesis of 1,2- benzanthracene, 1,2,5,6-di benzanthracene. (iv) Ortho-perifused polycyclic hydrocarbons: Occurance, synthesis of of Pyrene, Perylene and Coronene.	**08**
5	**DIAZONIUM SALTS** (i) Mechanism of diazotisation and method of preparation of diazonium salts. (ii) Nomenclature of diazonium salts. (iii) Reactions of diazonium salts, Replacement reactions in which nitrogen atom is eliminated and reactions in which nitrogen atoms are retained Application of diazonium salts. In the synthesis of aromatic compounds. (iv) Laws of coupling, coupling agents, Definition of diazoamino and aminoazo compounds. (v) Synthesis and uses of: Methyl orange, Methyl red, Congo red and Erichrome Black-T.	**08**
6	**REAGENTS** Synthesis and applications of following reagents. (i) Anhydrous aluminium chloride (ii) N-bromo succinimide (iii) Selenium dioxide (iv) Lithium aluminium hydride.	**08**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

(1) Organic Chemistry by R.T.Morison and R.N. Boyd, Prentice Hall India.
(2) Organic Chemistry vol-I & II by I.L.Finar.
(3) Organic Chemistry vol-I & II by B.K.Sharma, Goel pub. House, Merrut
(4) Reaction and reagents In Organic synthesis by O.P.Agrawal Goel pub. House,
(5) Organic Chemistry by S.H.Pine
(6) Reaction Mechanism in Organic chemistry by S.M. Mukharji & S.P. Singh.
(7) Organic Chemistry by L.G. Wade Jr. Pretice Hall.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Recognize properties of fundamental organic compounds.	20%
CO-2	Describe the structure and formation methods for organic compounds.	20%
CO-3	Produce and examine heterocyclic compounds.	20%
CO-4	Identify different polycyclic aromatic hydrocarbon.	10%
CO-5	Evaluate Diazotization and application of diazonium salts.	20%
CO-6	Prepare organic reagents.	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites

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BACHELOR OF SCIENCE
Course code: BC2204
Course name: Chemistry-V (Physical Chemistry)
Semester: III

Type of course: Core Course

Prerequisite: Should have basic knowledge about reactions and law involved in physical chemistry

Rationale: At the end of the course, students will have knowledge about reaction rates, basic of spectroscopy and electrochemistry.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**THEORIES OF REACTION RATE** Derivation of Arrhenius equation. Collision theory of reaction rate, Energy of activation including determination, Effect of catalysis on energy activation. Numerical problems	**08**
2	**PHOTOCHEMISTRY-I** Introduction of photochemistry, Basics of electromagnetic radiations, Photons, Thermal and photochemical laws (a) Grothus Draper's law (b) Lambert Beer's law (c) Einstein's law of photochemical equivalence. Quantum yield or efficiency. Experimental determination of Quantum yields. Reasons of low and high quantum yield. Numerical problems	**08**
3	**PHOTOCHEMISTRY-II** Primary and secondary photochemical reactions. Factors affecting quantum yield. (I.e. temperature, light intensity and inert gases). Isomeric changes, Polymerization, Photosensitization, Photo physical process [Fluorescence, Phosphorescence]. Chemilunescene. Factor affecting Fluorescence, Phosphorescence.	**08**
	SECTION-B	
4	**ELECTROLYTES OR ELECROCHEMISTRY-I** Ions in solution, formation of ion in solution metallic conductance, Electrolytic conductance, Electrolysis migration of ions, Transport number of ions and its determination by moving boundary method.	**08**

5	**ELECTROLYTES OR ELECROCHEMISTRY-II** Kohlraush law of ionic conductance. Application of Kohlraush law to (a) Determination of degree of dissociation of weak electrolyte. (b) Determination of equivalent conductivity of weak electrolyte at infinite dilution. (c) Determination of solubility and solubility product of sparingly soluble salts. (d) Determination of ionic product of water. Numerical problems.	**08**
6	**MOLECULAR SPECTROSCOPY** Electromagnetic radiation with wave length and energy. Radio frequency, Microwave, IR, UV-visible region, Pure rotational spectra, Vibrational and Vibrational-Rotational spectra. Raman spectra, Rotational spectra, calculation of bond length. Vibrational rotational spectra, Hook's law, Vibrational energy level. Numerical Problems.	**08**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Physical chemistry by Gurdeep Raj.
2. Physical chemistry by K.L.Kapoor vol.-I to V [Pub. Macmilan]
3. Advanced Physical chemistry by D.N.Bajpai.
4. Text book of Physical chemistry by S.C. Khetepal & Yogeshwar Sharma. [Pub. R.Chan
5. Physical chemistry by Puri & Sharma [S.Nagin & Co.]
6. A text book of Physical chemistry by A.S.Negi & Anand [New age International]
7. Physical chemistry by P.L.Soni & O.P.Dharmraj.
8. Physical chemistry by B.K.Sharma.
9. Essential of Physical chemistry by Bahl Tuli &Bahl.
10. Elemental Physical chemistry byGlasston & Lewis. .
11. Physical chemistry by K.K.Sharma, L.K.Sharma, Vikas Publication House, New Delhi.

Course Outcomes: After completing the course students will be able to

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Understand basic concepts of physical chemistry.	20%
CO-2	Explain about photochemistry.	20%
CO-3	Apply photochemical reactions.	20%
CO-4	Outline of electrolytes.	10%
CO-5	Evaluate the fundamental of electrochemistry.	20%
CO-6	Generalize the molecular spectroscopy.	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/

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BACHELOR OF SCIENCE
Course code: BC2205
Course name: Chemistry Practicals
Semester: III

Type of course: Core Course

Prerequisite: Should have basic knowledge about lab utilities and its applications.

Rationale: At the end of the course, students will have knowledge about organic separations, gravimetric estimations and physical instruments.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
0	0	4	2	-	-	70	30	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	ORGANIC SPOTTING-I	**14**
2	PHYSICAL PRACTICALS-I	**10**
3	GRAVIMETRIC ESTIMATION	**06**
	SECTION-B	
4	ORGANIC SPOTTING-II	**14**
5	PHYSICAL PRACTICALS-II	**10**
6	VOLUMETRIC EXERCISE	**06**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. A text book of practical organic chemistry – A. I. Vogel
2. Practical organic Chemistry – Mann and Saunders
3. Comprehensive Practical Organic Chemistry: Preparations and Quantitative Analysis V K Ahluwalia & R. Aggarwal Universities Press.

4. An Advance Course in practical Chemistry, A K. Nad, B. Mahapatra and A. Ghoshal.
5. Advanced Practical Inorganic Chemistry, Gurdeepraj, Goel Publishing House, 2001.
6. An Advanced Course in Practical Chemistry, A.K. Nad, B. Mahapatra, A. Ghosal, New Central Book Agency, 2004.
7. Practical physical chemistry –J.B.Yadav
8. Practicals in physical chemistry – P.S.Sindhu
9. Experimental physical chemistry – R.C.Das, B.Behera
10. Analytical Chemistry Practice, John H. Kennedy, Saunders College Publishing, Second Edition 1990.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Recognize the type of organic compound.	20%
CO-2	Identify and interpret the application of physical instrument.	20%
CO-3	Calculate the organic estimation.	20%
CO-4	Identify and inspect the type of organic compound.	10%
CO-5	Justify the physical properties.	20%
CO-6	Explain volumetric reactions.	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/

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BACHELOR OF SCIENCE
Course code: BC2206
Course name: Physics-III
Semester: III

Type of course: Core Course

Prerequisite: Should have fundamental knowledge of crystallography, quantum physics and nuclear physics.

Rationale: Students will enhance the knowledge about crystallography, acoustics, nuclear physical tools and quantum mechanics at the end of the course.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	-	4	6	70	30	70	30	200

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**CRYSTAL PHYSICS** The crystalline State: Crystalline, polycrystalline and glassy materials; Properties of solids, Crystallographic terms: Space lattice, crystal lattice, basis, unit cell, primitive unit cell, Bravais lattice, Space lattices of cubic systems, Calculation of lattice constant, Miller indices ,Distance of separation between successive *hkl* planes , Bragg's Law, Laue's interpretation of X-ray diffraction by crystals.	8
2	**QUANTUM PHYSICS-I** Introduction, Black Body Radiation, Distribution of energy in the spectrum of Black Body Radiation, Wien's law of energy distribution, Rayleigh-Jeans law, Failures of classical theory to explain the spectral distribution of energy, Photoelectric effect, failures of classical theory to explain photoelectric effect, Einstein photoelectric effect, The Compton effect, The direction of recoil electron, failures of classical theory to explain Compton effect, Explanation of Compton effect on the basis of Quantum Theory, Wave Particle Dualism.	8
3	**NUCLEAR PHYSICS** Physical Tools: Introduction, Interaction between particles and matter Detectors for nuclear particles (i) Proportional counter (ii) Geiger counter (iii) scintillation counter (iv) semi-conductor detectors (v) cloud and bubble chambers (vi) spark chamber Particle Accelerators: Need for an accelerator of charged particles,(i) Van de Graff Generator (ii) Cyclotron (iii) Synchrotron (iv) Betatron; Beta ray spectrometer.	8

SECTION-B		
4	**ARCHITECTURAL ACOUSTICS** Introduction, Architectural Acoustics, Intensity and intensity level, Properties of musical sound, Sabine's formula, Reverberation time-theoretical treatment, Reverberation time of a live room, Reverberation time of a dead room, optimum reverberation time. Factors affecting for acoustics of buildings.	**8**
5	**QUANTUM PHYSICS-II** De-Broglie Hypothesis, De-Broglie wavelength of a charged particle accelerated by an electric field, Comparison between Matter waves and Electromagnetic waves, Bohr's quantization condition, Davisson and Germer Experiment, Heisenberg's Uncertainty relation- Statement, proof, physical significance, Illustration of uncertainty principle by thought experiments, Heisenberg's Uncertainty principle from De-Broglie wave concept.	**8**
6	**SPECIAL THEORY OF RELATIVITY** Introduction, Frame of reference, Galilean Transformation, Insufficiency of Galilean Transformation equations, Michelson-Morley Experiment, Postulates of special theory of relativity, Time Dilation, Doppler Effect, Length Contraction, Twin Paradox, Lorentz transformation of space and time, Consequences of Lorentz transform equations.	**8**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Introduction to Solid State Physics by Charles Kittel, 8th Ed., John Wiley and Sons, 2005
2. Elements of Solid State Physics (2 Edition) by J. P. Srivastava, PHI Learning.
3. Solid State Physics (6th Edition) by S.O. Pillai, New Age International Publishers
4. Nuclear physics, an introduction by S. B. Patel, New Age International (P) Ltd
5. Nuclear Physics by D.C. Tayal, Himalaya Publishing House
6. A textbook on oscillations, waves & acoustics by M. Ghosh, D. Bhattacharya, S. Chand
7. Modern Physics by R. Murugeshan and K. Sivaprasath, (S. Chand & Company Ltd.)
8. Concepts of Modern Physics by Arthur Beiser, 6th Ed., TataMcGraw-Hill Publishing Co. Ltd. New Delhi, 2003
9. A Textbook of Quantum Mechanics by P M Mathews, K Venkatesan, 2nd Edition, TataMcGraw-Hill Publishing Co. Ltd. New Delhi, 2010

List of Practical/ tutorials: (Practical's – 10)

1. To determine the Cauchy's constant of the given prism.
2. To determine the refractive index of the material of a prism.
3. To study various crystals structures by Virtual lab.
4. Determination of Stefan- Boltzmann constant σ.
5. To understand the phenomenon Photoelectric effect as a whole and to draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
6. To determine the stopping potential from the photocurrent versus applied reverse potential in photoelectric effect.
7. To Verify Norton's theorem and to find equivalent Norton's components
8. To Verify Thevenin's theorem and to find equivalent Voltage of source circuit
9. Absorption coefficient of liquid using photocell.
10. To study double refraction in calcite prism
11. .To study Resolving power of grating.
12. To determine the wavelength of light by Biprism.

Course Outcomes:

After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Recognize the elemental solids and properties.	20%
CO-2	Understand the failures of classical theory to explain black body radiation, Compton effect and photoelectric effect.	20%
CO-3	Develop the understanding for the nuclear physics	15%
CO-4	Point out the architectural acoustics.	15%
CO-5	Compare matter waves - electromagnetic waves and Illustration of uncertainty principle by thought experiments	15%
CO-6	Summarize the basic concepts of special theory of relativity.	15%

List of Open Source Software/learning website:

- **https://ocw.mit.edu/courses/physics/**
- **https://www.einstein-online.info/en/category/elementary/**

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BACHELOR OF SCIENCE
Course code: BC2207
Course name: Industrial Organic Chemicals
Semester: III

Type of course: Generic Elective

Prerequisite: Should have basic knowledge about day to day chemistry.

Rationale: At the end of the course, students will have knowledge about industrial products- its preparation and applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	0	2	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**SYNTHETIC FIBERS WITH FLOWSHEET DIAGRAM** (1) Tetrafluoroethylene, Teflon (2) Nylon-6,10 (3) DMT, Ethyleneglycol, Terylene **SYNTHETIC RUBBERS WITH FLOW SHEET DIAGRAM** (1) Isoprene, Polyisoprene (2) Silicone Rubber (3) Polyurethane rubber	**04**
2	**PLASTICS AND RESINS WITH FLOW SHEET DIAGRAM** (1) Urea formaldehyde resin, Bakelite (2) Vinylchloride, PVC (3) Vinylalcohol, Polyvinyl alcohol (4) Melamine and melamine resin (5) Bisphenol-A, Epoxy resin (6) Propylene, Polypropylene	**04**
3	**FATS, OILS, SOAPS AND DETERGENTS** Animal and vegetable oils, drying and non-drying oils, hydrogenation, iodine value, RM. value and saponification value, soaps and detergents, mechanism of cleansing action of soap and detergents.	**04**
	SECTION-B	
4	**EXPLOSIVES** (1) RDX (2) Nitrocellulose (3) Glyceryl trinitrate (4) Trinitro phenol	**04**

	(5) TNT (6) Amatol	
5	**SYNTHETIC DRUGS** (1) Novacaine (2) Novalgin (3) Paludrine (4) Paracetamol (5) Sulphatiazole (6) Benadryl (Diphenyl hydramine)	**04**
6	**SYNTHETIC DYES** (1) 3-phenyl, 7-methoxy coumarin (2) Blankophore-B (3) Eriochrome Black-T (4) Eosin (5) Alizarine (6) Indanthrene khaki-GG	**04**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Handbook of Industrial Chemistry Organic chemicals by M. Ali, Bassam El Ali
2. Industrial Chemistry by Samuel Rideal
3. Industrial Chemistry by James A. Audley
4. Handbook of Industrial chemistry Cory Simmons.
5. Riegels Handbook of Industrial Chemistry
6. Ullmanns Encyclopedia of Industrial Chemistry

Course Outcomes: After completing the course students will be able to

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Identify different synthetic fibers and rubber	20%
CO-2	Illustrate different types of plastics and resin	20%
CO-3	Discover the basic knowledge about Industrial organic chemicals	20%
CO-4	Point out the use of explosives	10%
CO-5	Outline and explain about drugs.	20%
CO-6	Formulate and summarize synthetic dyes	10%

List of Open Source Software/learning website:

https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/

- https://blog.feedspot.com/chemistry_websites/

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B.Sc. Sem. IV

Teaching/Exam Scheme

w.e.f.: 1st April'22

Sr. No.	Course code	Category of course	Course title	Hours Per week			Tot. Con. hrs.	Credits	E	M	I	V	Total Marks
				L	T	P							
1	BC2209	Foundation Compulsory	Basics of Communication Skills	2	-	-	2	2	70	30	-		100
2	BC2210	Core Course	Chemistry-VI	4	-		4	4	70	30			100
3	BC2211	Core Course	Chemistry-VII	4	-		4	4	70	30			100
4	BC2212	Core Course	Chemistry-VIII	4	-	-	4	4	70	30			100
5	BC2213	Core Course	Chemistry Practical - II	-	-	4	4	2			30	70	100
6	BC2214	Core Course	Physics- IV	4		4	8	6	70	30	30	70	200
7	BC2215	Generic Elective	Industrial Inorganic Chemicals	2	-	-	2	2	70	30	-		100
8	BC2216	Compulsory Elective	Seminar	1	-	-	1	1	50	-	-	-	50
			Total	21	0	8	29	25	470	180	60	140	850

Generic Elective	1. Industrial Organic Chemicals 2. Industrial Inorganic Chemicals
Compulsory Elective	Seminar

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BACHELOR OF SCIENCE
Course code: BC2209
Course name: Basics of Communication Skills
Semester: IV

Type of course: Foundation Compulsory

Prerequisite: Zeal to learn the subject.

Rationale: At the end of the course, students will have knowledge about the overall communication. It also targets the understanding of communication through its process and the various stages. This would be developed through balanced and integrated tasks.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	-	-	2	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**Basics of Communication:** Communication Skills, Shannon and Weaver Model of Communication, Verbal and Non Verbal Communication, General and Scientific Communication**.**	**06**
2	**Language in Communication:** Language as a Tool, Flow of Communication- Downward, Upward, Vertical, Horizontal and Grapevine.	**04**
3	**Barriers in Communication:** Language Barrier, Cultural Barrier, Gender Barrier, Attitudinal Barrier and Psychological Barrier**.**	**03**
	SECTION-B	
4	**Non-Verbal Communication:** Body Language, Paralinguistic features, Proxemics, Chronemics and Haptics.	**04**
5	**Verbal Communication:** Face to face conversation, Conversation through text/messaging, Oral conversation.	**03**
6	**Basic Speaking Skills:** Speaking on a given topic, Verbal and Non-Verbal Interaction.	**04**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**20**	**10**	**10**	**20**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Communication Skills, Sanjay Kumar and Pushp Lata, Oxford University Press, 2011.
2. Practical English Usage, Michael Swan, OUP, 1995.
3. Essential English Grammar with Answers by Raymond Murphy (Cambridge University Press)
4. Technical Communication, Meenakshi Raman & Sangeeta Sharma. Oxford University Press,2015.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understanding the fundamentals of communication Skills.	20%
CO-2	Enhancing the communication skills and its related aspects.	20%
CO-3	Relate themselves orally using simple English.	20%
CO-4	Understanding the importance of scientific communication	10%
CO-5	Confidently presenting oneself in workplace & professional setting.	10%
CO-6	Presenting oneself as capable representative in the professional field.	20%

List of Open Source Software/learning website:

- http://www.english-online.org.uk/
- http://www.learnenglish.de/

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BACHELOR OF SCIENCE

Course code: BC2210

Course name: Chemistry-VI (Inorganic Chemistry)

Semester: IV

Type of course: Core Course

Prerequisite: Should have basic knowledge about periodic elements and complexes.

Rationale: At the end of the course, students will have knowledge about nomenclatures and properties of elements and complexes.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**CHEMISTRY OF LANTHANIDE ELEMENTS** Lanthanide elements: Electronic configuration, Sources. Occurrence, Lanthanide contraction, Use of Lanthanide compounds Properties (Spectral and Magnetic), Mitch metal.	**08**
2	**CHEMISTRY OF ACTINIDE ELEMENTS** Actinide elements: Electronic configuration, Sources. Occurrence, Actinide contraction, Use of Actinide compounds Properties (Spectral and Magnetic).	**08**
3	**METAL COMPLEXES** Introduction, Werner's coordination theory, CFSE, Factors affecting on CFSE, Application of CFT (Magnetic properties, Spectral properties) Nomenclature of complexes (Nomenclature rules, Examples of Common monodentate and Multidentate ligands).	**08**
	SECTION-B	
4	**HYDROGEN BONDING** Theory of hydrogen bonding, classification, importance of hydrogen bonding in ice, Effect of hydrogen bonding in various fields.	**08**
5	**ION-EXCHANGE CHROMATOGRAPHY** Synthesis and Characterization of ion exchanger, Basic requirements of ion exchange resin. Types of ion-exchange resin. Technique of ion exchange, Application of ion exchange for Separation.	**08**
6	**NON AQUEOUS SOLVENTS** Introduction, classification of solvents, Properties characterizing of solvents, protonic non aqueous solvents (liquid ammonia, anhydrous sulphuric acid), aprotic solvents (liquid SO2).	**08**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Theoretical Inorganic Chemistry by M. C. Day & J. Selbin Affiliated, East West Pub. Pvt. Ltd.
2. Coordination Compounds (Studies in Modern Chemistry) S. F. A. Kettle, Nelson.
3. Inorganic Chemistry by (Principles of Structure and Reactivity) James E. Huhely, Harper International (NY).
4. Inorganic Chemistry by R. B. Heslop and P. L. Robinson Elsevier Pub. Co. NY.
5. Physical Methods Inorganic Chemistry by R. S. Drago, W.B.S. Saunders Co. London, Reinhold Pub. Co. NY.
6. Quantitative Analysis Day & Underwood Prentice Hall of India, Pvt. Ltd.
7. Principles of Inorganic Chemistry (Puri, Sharma, Kalia).
8. Advanced Inorganic Chemistry Vol. I & II by Gurudeep Raj, Goel Pub. House, Meerut.
9. Advanced Inorganic Chemistry by Cotton & Wilkinson John Wihn Wiely.
10. Inorganic chemistry by Gray L. Miessler, Donald A. Tarr, 3" addition, Pearson publication.
11. General and Inorganic chemistry (part-I & II) by R. Sarkar, Books and Allied (P) Itd.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Recognize the relative stability of f-block elements.	20%
CO-2	Clear basic understanding for the inorganic elements	20%
CO-3	Develop and theoretical aspects of metal complexes	20%
CO-4	Classify hydrogen bonding and its significance.	10%
CO-5	Explain synthesis and characterization of ion exchanger	20%
CO-6	Categorize properties of non-aqueous solvents	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/

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BACHELOR OF SCIENCE

Course code: BC2211

Course name: Chemistry-VII (Organic Chemistry)

Semester: IV

Type of course: Core Course

Prerequisite: Should have basic knowledge about reaction mechanism and spectroscopy.

Rationale: At the end of the course, students will have knowledge about properties, synthesis and reactions about various organic compounds.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**ELIMINATION REACTION** Introduction, □□ elimination, E1-mechanism, E2-mechanism, Stereo chemistry of elimination reactions, Elimination v/s substitution, □□ -elimination, Generation of carbenes and Ketenes.	**08**
2	**NAME REACTIONS** **General nature, Reaction mechanism and applications of the following reactions:** (1) Fridel Craft reaction (2) Aldol condensation (3) Dickmann reaction (4) Michael reaction (5) Wolf-Kishner reduction (6) Mannich Reaction (7) Reimer Tiemann reaction (8) Wittig reaction	**08**
3	**COMPOUNDS CONTAINING REACTIVE METHYLENE GROUP** (a) Malonic ester: Preparation from acetic acid and its synthetic applications (n-butyric acid, n-caproic acid, succinic acid, adipic acid, cinnamic acid and barbituric acid) (b) Acetoacetic ester (Ethyacetoacetate): Preparation and synthetic applications (butanone, 1, 3 and 1, 4-diketone, alicyclic compound.) (c) Keto-enol tautomerism: Factors affecting keto-enol tautomerism and its mechanism.	**08**
	SECTION-B	

4	**CARBOHYDRATES** (a) General introduction: (b) Disaccharides: Structure elucidation of maltose, lactose and sucrose (c) Methods of methylating sugar.	**08**
5	**ORGANIC SULPHUR COMPOUNDS** (a) Aliphatic sulphur: Nomenclature, General methods of preparation and reactions of mercaptans, thioethers, sulfinic acid and sulfonic acids (b) Aromatic Sulfonic acid: Nomenclature, General methods of preparation and uses of Sulfonic acids of toluene.	**08**
6	**ELECTROMAGNETIC SPECTRUM:** UV and visible spectroscopy, Ultraviolet absorption spectroscopy, absorption laws, (Beer- Lambert law) terminology used in UV and visible spectra, Molar absorptivity, Types of electronic transitions, effect of conjugation, concept of chromophore and Auxochrome and hypsochromic shifts UV spectra of conjugated enes and enones, effect of solvent substitution on electronic transition. Problems based on calculation of max for conjugated dienes and Unsaturated carbonyl compounds and substituted benzene derivatives using relevant rule.	**08**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

(1) Organic Chemistry by R.T.Morison and R.N. Boyd, Prentice Hall India.
(2) Organic Chemistry vol-I & II by I.L.Finar.
(3) Organic Chemistry vol-I & II by B.K.Sharma, Goel pub. House, Merrut
(4) Reaction and reagents In Organic synthesis by O.P.Agrawal Goel pub. House, Merrut.
(5) Organic Chemistry by S.H.Pine
(6) Reaction Mechanism in Organic chemistry by S.M. Mukharji & S.P. Singh.
(7) Organic Chemistry by L.G. Wade Jr. Pretice Hall.

Course Outcomes: After completing the course students will be able to

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Identify elimination and substitution reaction	20%
CO-2	Explain different kind of name reactions.	20%
CO-3	Examine the organic compounds containing reactive methylene group.	20%
CO-4	Analyze carbohydrates	10%
CO-5	Summarize organic sulphur compounds.	20%
CO-6	Explain the concepts of electromagnetic spectrum	10%

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List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/

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BACHELOR OF SCIENCE
Course code: BC2212
Course name: Chemistry-VII (Physical Chemistry)
Semester: IV

Type of course: Core Course

Prerequisite: Should have basic knowledge about reactions and law involved in physical chemistry

Rationale: At the end of the course, students will have knowledge about reaction rates, basic of spectroscopy and electrochemistry.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**PARTITION CO-EFFICINT** Explanation of Nernst distribution law and its conditions for the validity. Complications arising in distribution law: (a) Association of solute in one of the phases. (b) Dissociation of solute in one the phases. (c) Dissociation of solute in both the phases. Derivation of distribution law from kinetic consideration explanation of solvent extraction process. Numerical Problems	**08**
2	**ADSORPTION** Adsorption and absorption, Heat of adsorption, Characteristics of Adsorption, Physical adsorption and chemical adsorption. Distinction between physical adsorption and chemical adsorption, Freundlich's adsorption isotherm, Langmuir's adsorption Isotherm. Catalysis, General features of catalysis. Heterogeneous catalysis, Adsorption theory of catalysis.	**08**
3	**CONDUCTOMETRIC TITRATIONS** Principle, Types of conductometric titrations: (a) Strong acid v/s strong base (b) Strong acid v/s weak base (c) Weak acid v/s strong base (d) Weak acid v/s weak base (e) Mixture of Strong acid and weak acid v/s strong base (f) Precipitation titration of:	**08**

	(i) BaCl2 v/s K2CrO4 (ii) NaCl v/s AgNO3 Advantages of conductometric titrations over indicator method	
	SECTION-B	
4	**IONIC EQUILIBRIA** Relation between degree of hydrolysis, Hydrolysis constant and pH of solutions of: (a) Salts of weak acid v/s strong base (b) Salts of strong acid v/s weal base (c) Salts of weak acid v/s weak base Theories of acid-base indicators. Oswald and Quinonoid theories, Choice of indicators, Indicator exponent and useful range of pH of an indicator. Numerical Problems	**08**
5	**THEMODYNAMICS-I** Free energy or work function [Gibbs free energy (G) and Helmholtz free energy (A). Derivation Gibbs Helmholtz equation. Derivation of G=G0+RTlnp. Helmholtz equation, Relation of ΔG and equilibrium constant Kp (Vant Hoff isotherm and isochore) Numerical problems	**08**
6	**THEMODYNAMICS-II** Derivation of Clapeyron and Clapeyron-Clauius equation. Application of Clapeyron-Clausius equation in the derivation of Molal elevation constant & Molal depression constant. Numerical problems	**08**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Physical chemistry by Gurdeep Raj.
2. Physical chemistry by K.L.Kapoor vol.-I to [V [Pub. Macmilan]
3. Advanced Physical chemistry by D.N.Bajpai.
4. Text book of Physical chemistry by S.C. Khetepal & Yogeshwar Sharma. [Pub. R.Chand]
5. Physical chemistry by Puri & Sharma [S.Nagin & Co.]
6. A text book of Physical chemistry by A.S.Negi & Anand [New age International]
7. Physical chemistry by P.L.Soni & O.P.Dharmraj.
8. Physical chemistry by B.K.Sharma.
9. Essential of Physical chemistry by Bahl Tuli &Bahl.
10. Elemental Physical chemistry byGlasston & Lewis. .
11. Physical chemistry by K.K.Sharma, L.K.Sharma [Vikas Publication House, New Delhi.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Present key concepts of physical chemistry.	20%
CO-2	Explain the concept of adsorption and absorption	20%
CO-3	Demonstrate the conductometric titration	20%
CO-4	Outline about Ionic equilibria and indicator	10%
CO-5	Interpret mathematical concepts of thermodynamics.	20%
CO-6	Derive the Clapeyron-Clauius equation and its application.	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/

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BACHELOR OF SCIENCE
Course code: BC2213
Course name: Chemistry Practicals
Semester: IV

Type of course: Core Course

Prerequisite: Should have basic knowledge about lab utilities and its applications.

Rationale: At the end of the course, students will have knowledge about organic separations, gravimetric estimations and physical instruments.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
0	0	4	8	-	-	70	30	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	INORGANIC QUALITATIVE ANALYSIS-I	**14**
2	PHYSICAL PRACTICALS-I	**10**
3	ORGANIC ESTIMATIONS	**06**
	SECTION-B	
4	INORGANIC QUALITATIVE ANALYSIS-II	**10**
5	PHYSICAL PRACTICALS-II	**06**
6	ORGANIC PREPARATION	**14**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. A text book of practical organic chemistry – A. I. Vogel
2. Practical organic Chemistry – Mann and Saunders

3. Comprehensive Practical Organic Chemistry: Preparations and Quantitative Analysis V K Ahluwalia & R. Aggarwal Universities Press.
4. An Advance Course in practical Chemistry, A K. Nad, B. Mahapatra and A. Ghoshal.
5. Advanced Practical Inorganic Chemistry, Gurdeepraj, Goel Publishing House, 2001.
6. An Advanced Course in Practical Chemistry, A.K. Nad, B. Mahapatra, A. Ghosal, New Central Book Agency, 2004.
7. Practical physical chemistry –J.B.Yadav
8. Practicals in physical chemistry – P.S.Sindhu
9. Experimental physical chemistry – R.C.Das, B.Behera
10. Analytical Chemistry Practice, John H. Kennedy, Saunders College Publishing, Second Edition 1990.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Recognize the type of inorganic compound.	20%
CO-2	Identify and interpret the application of physical instrument.	20%
CO-3	Calculate the organic estimation.	20%
CO-4	Identify and inspect the type of inorganic compound.	10%
CO-5	Justify the physical properties.	20%
CO-6	Explain organic preparation.	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/

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BACHELOR OF SCIENCE
Course code: BC2214
Course name: Physics-IV
Semester: IV

Type of course: Core Course

Prerequisite: Should have fundamental knowledge of sound, LASER and bridges.

Rationale: At the end of the course, students will have knowledge about LASERS, ultrasound, superconductors, bridges and statistical mechanics

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	-	4	6	70	30	70	30	200

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**LASERS** Introduction, Laser beam characteristics, Thermal equilibrium, Interaction of light with matter, Einstein coefficients and their relations, Basic principle of LASER, Theory of Light amplification, Components of Laser, Lasing action, Principal pumping schemes, Type of lasers, Pulsed Ruby Laser, He-Ne Laser, Nd: YAG Laser , Applications of laser	8
2	**STATISTICAL MECHANICS-I** Macroscopic and microscopic states: Macroscopic states, Microscopic states, Phase spaces, μ-space, Γ- space, Postulate of equal a priori probabilities, Ergodic hypothesis, Density distribution in phase space, Liouville's theorem, Principle of conservation of density in phase and principle of conservation of extension in phase, Condition for statistical equilibrium,	8
3	**SUPERCONDUCTIVITY** Introduction, General features of superconductors, Meissner effect, Types of superconductors, Penetration depth, Mechanism of superconductivity: BCS theory, Josephson junction and its applications, Applications of superconductor: cyclotron, SQUID, Superconducting magnets, Maglev etc	8
	SECTION-B	
4	**ULTRASONICS** Introduction, Properties of ultrasonic, Production of Ultrasonic waves: Magneostriction method, Piezo-electric method, Measurement of velocity of ultrasonic waves, Acoustic grating method, Detection of ultrasonic waves: Piezo-electric detector, kundt's tube method, Sensitive flame method, thermal detector, Application of ultrasonic.	8

5	**STATISTICAL MECHANICS-II** Statistical ensemble: Micro canonical ensemble, Canonical ensemble, Mean value and fluctuations, Grand canonical ensemble, Fluctuations in the number of particles of a system in a grand canonical ensemble. Some applications of Statistical mechanics: Thermodynamics, Statistical interpretation of basic thermodynamic variables, Ideal gas, Gibbs paradox, the equipartition theorem	**8**
6	**AC BRIDGES** Impedance Bridge, Measurement of Inductance (a) Maxwell's Impedance Bridge (b) Maxwell's LC bridge (c) Owen's Bridge: (d) Anderson's Bridge, Measurement of Capacitance (a) De Sauty's Bridge (b) Wien's Bridge (c) Schering Bridge, Measurement of frequency (low)	**8**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. A text book of Optics by N. Subrahmanyam, Brijlal and M. N. Avadhnulu, S. Chand Publication
2. Fiber Optics and optoelectronics by R. P. Khare, Oxford University Press.
3. An introduction to LASERS- Theory and Applications by M. N. Avadhanulu, S. Chand & Comp. Ltd.
4. Fundamentals of Statistical Mechanics by B.B. Laud, New Age International Publishers
5. Mechanics, Wave motion & Heat by Francis Weston Sears (Addision Wesley Publication)
6. A text book on oscillations, waves & Acoustics by M. Ghosh, D. Bhattacharya (S. Chand)
7. Introduction to Statistical Mechanics by S. K. Sinha, Narosa Publication
8. Electricity and Magnetism by D C Tayal, 4th Revised Ed.,Himalaya Publishing House, India, 2019

List of Practical/ tutorials:

1. To find the velocity of sound waves in a given rod with Kundt's tube apparatus.
2. Determine the velocity of liquids by ultrasonic interferometer.
3. To draw characteristics of triode/tetrode valve.
4. To determine the dielectric constant of a given liquid by Schering bridge.
5. To determine the self-inductance of a coil by Owen's bridge.
6. Measurement of inductance by Maxwell's Bridge.
7. To determine wavelength of LASER beam using plane transmission grating.
8. To study divergence of LASER beam
9. To determine the angle of emergence *i'* for varours angle of incidence *i* and to draw the *i*-*i'* curve.

10. Find the angles of deviation corresponding to various angles of incidence and draw the i-d curve.
11. To determine the inductance by Anderson's Bridge.
12. C1/C2 by Desauty"s method

Course Outcomes:After completing this course, student will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Present the phenomenon based on LASER and its types.	20%
CO-2	Formulate general mechanism for statistical mechanics and Condition for statistical equilibrium.	15%
CO-3	Demonstrate the knowledge about superconductors and its applications.	20%
CO-4	Outline about production, detection, properties and uses of ultrasonic waves.	15%
CO-5	Develop the understanding of Statistical ensembles and applications of statistical mechanics.	15%
CO-6	Derive the methods for the measurement of impedance and capacitance using various bridges.	15%

List of Open Source Software/learning website:
https://ocw.mit.edu/courses/physics/
https://www.einstein-online.info/en/category/elementary/

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BACHELOR OF SCIENCE
Course code: BC2215
Course name: Industrial Inorganic Chemicals
Semester: IV

Type of course: Generic Elective

Prerequisite: Should have basic knowledge about day today chemistry.

Rationale: At the end of the course, students will have knowledge about industrial products- its preparation and applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	0	2	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**PHOSPHOROUS CONTAINING COMPOUNDS** (1) Red Phosphorus (2) Sodium hexametaphosphate (3) PCls (4) Phosphoric acid	**04**
2	**FERTILIZERS** Definition and classification of fertilizers, Direct and indirect fertilizers, Natural and synthetic fertilizer, Symptoms of deficiency of some elements like N, K, and P.	**04**
3	**IMPORTANT INORGANIC CHEMICALS:** Preparation and uses of (1)Alluminium Sulphate (2) Ferrous Sulphate (3) Red Oxide Pigment (4) C-Black (5) Sulfuric acid (6) Nitric acid	**04**
	SECTION-B	
4	**INDUSTRIAL PREPARATION AND USES OF** (1) Potassium permanganate (2) Bleaching powder by Bachmann's method (3) Hydrogen peroxide	**04**
5	**GLASSES** Classification, properties and uses of glasses.	**04**

6	**NON FERROUS ALLOYS** Monel metal, Duralumin, Wood metal, Babit metal, Phosphorus bronze, Brass, German silver.	**04**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Handbook of Industrial Chemistry Organic chemicals by M. Ali, Bassam El Ali
2. Industrial Chemistry by Samuel Rideal
3. Industrial Chemistry by James A. Audley
4. Handbook of Industrial chemistry Cory Simmons.
5. Riegels Handbook of Industrial Chemistry
6. Ullmanns Encyclopedia of Industrial Chemistry

Course Outcomes: After completing the course students will be able to

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Present the core concepts of industrial inorganic chemicals	20%
CO-2	Discuss about fertilizers.	20%
CO-3	Prepare important inorganic chemicals.	20%
CO-4	Categorize the various application of industrial chemicals	10%
CO-5	Evaluate properties and uses of glasses	20%
CO-6	Summarize nonferrous alloys	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/