DEPARTMENT OF CHEMISTRY

B.Sc. CHEMISTRY

(Students admitted during 2020-2021 Onwards)

(Under CBCS with Outcome Based Education (OBE) Pattern)

SYLLABUS

III & IV SEMESTER

GOBI ARTS & SCIENCE COLLEGE

(Govt. Aided Autonomous Co-educational Institution, Affiliated to
Bharathiar University, Coimbatore, Accredited with 'A' Grade by NAAC (4th cycle)
and Recognised as a STAR College by DBT, Government of India)

KARATTADIPALAYAM POST,

GOBICHETTIPALAYAM - 638453

ERODE DISTRICT.

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remember; **K2**- Understanding; **K3**- Apply; **K4**-Analyze; **K5**- Evaluate

I. END OF SEMESTER (EOS) EXAMINATIONS:

1. Part I, II & III-Theory: 70 Marks

Knowledge Level	Section	Marks	Description	Total
K1	A (Answer All)	15 × 1 = 15	MCQ	70
K2	B (Either or Pattern)	5 × 5 = 25	Short answers	
K3 & K4	C (Answer 3 out of 5)	3 × 10 = 30	Descriptive/Detailed	

2. Practical Examinations: 70 Marks

Knowledge Level	Section		Total
	Practical	Record work	
K3	60	10	70
K4			
K5			

II. CONTINUOUS INTERNAL ASSESSMENT (CIA):

1. Test – I & II: 30 Marks (Theory)

Knowledge Level	Section	Marks	Description	Total
K1	A (Answer All)	10 × 1 = 10	MCQ	30
K2	B (Answer 2 out of 3)	2 × 5 = 10	Short answers	
K3 & K4	C (Answer 1 out of 2)	1 × 10 = 10	Descriptive/Detailed	

2. Practical Internal Assessment: 30 Marks

Knowledge Level	Section		Total
	Test	Lab Performance	
K3	20	10	30
K4			
K5			

Components of Continuous Internal Assessment (CIA)

Components		Calculation	CIA Total
Test 1	30	$\frac{\text{Test 1 + Test 2}}{2}$	30
Test 2	30		

Programme Code:	B.Sc.	Programme Title:	Chemistry	
Course Code:	19UACH03	Course Title:	Batch:	2019
Total Hours:	75	General Chemistry – III	Semester:	III
			Credits:	4.0

Course Objective

The course aims

- To learn the principles of volumetric analysis and acid-bases.
- To understand the fundamental concepts of computer.
- To know about mechanism of carbonyl and carboxylic acid compounds.
- To understand the concept of phase rule and chemical equilibrium.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K2	CO1	Create awareness of the volumetric titration and acid–base concept.
K2, K3	CO2	Explain fundamentals and C-programme in computers.
K2	CO3	Predict the various organic mechanisms.
K2, K3	CO4	Identify the properties of dicarboxylic acids.
K1, K2	CO5	Describe the phase rule and kinds of solutions.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate

SYLLABUS

Unit	Content	No. of Hours
I	**Volumetric analysis:** Principle, Preparation of standard solutions, types of titration. Indicators: Theory and the choice in acid –base titration, redox titrations: Fe^{+2} vs $K_2Cr_2O_7$ using internal and external indicators - Complexometric titration: EDTA vs Mg^{+2}. **Acids-Bases:** Theories of acids and bases – Arrhenius, Bronsted-Lowry, Lewis, Lux Flood and Usanovich and Solvent system concept. HSAB principle-Non-aqueous solvents: physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.	15
II	**Fundamentals of computers**: computer system organization - the operating systems-DOS commands-problem solving in computers - algorithm-flow chart-program execution-fundamentals of Basic language-character set-constants and variables-operators- flow chart and program-to compute normality, molality and molarity values for the given solution- rate constant and half life for a first order reaction-molecular weight from osmotic pressure. **Fundamentals of C-programming:** variables -characters-constants-operators-statement in 'C'. Programs in 'C'-program for addition-program to compute average velocity. Computer software in chemistry-chemical inventory system-electronic hand books-chemical. Structure and information database-molecular modeling program-chem office-chem draw. Internet- Chemistry software site. Bio-informatics.	15
III	**Reactivity of carbonyl group**: acidity of α–hydrogen, Mechanism of Aldol condensation, Perkin, Knoevenagal, Wittig, Reformatsky, Cannizaro, haloform reactions and Micheal addition. Mechanisms of reduction of carbonyl compounds:	15

	$LiAlH_4$, $NaBH_4$ Wolf-Kishner, Meerwin-Pondorf Verley, Clemmensen, 1,3-dithiane, Rosenmund reduction.	
IV	**Oxidation reactions:** Oppenauer oxidation, Bayer- Villiger oxidation, Dakin reaction. **Dicarboxylic acids:** preparation and properties of oxalic, malonic, succinic and adipic acids. **Hydroxy acids:** Preparation and properties of citric acid, Lactic acid. Preparation and synthetic uses of acetoacetic ester and malonic ester. **Tautomerism:** Keto-enol, amido-imido, nitroso-oxime and nitro-acinitro. Differences between tautomerism and resonance.	**15**
V	**Phase rule**: Phase equilibria in simple systems, the equilibrium conditions, stability of phase of pure substance. Pressure dependence of μ versus T curves, the Clapeyron equation and Clausius – Clapeyron equation. Derivation of Gibbs phase rule. Phase equilibria in one component system – the phase diagrams for H_2O and sulphur. Reduced phase rule, Lead-Silver system, Thermal analysis, Nernst distribution law. **Solutions:** Definition, Kinds of solution, expressing the concentration of a solution, solutions of gases in liquid, Factors affecting solubility of gases, Henry's law. Solutions of liquid in liquid, Raoult's law, ideal and non-ideal solutions, Chemical potentials of ideal and non-ideal solutions. Gibb's Duhem margules equation.	**15**

<* - ***Self study: Study of general properties of carbonyl compounds*>.**

Text Books:

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Advanced Inorganic Chemistry, S.Chand and Sons, 31st edition (2011).
2. A. Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand and Sons, 5th edition (2010).
3. B.R Puri, L.R Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Company, 46th edition (2012).
4. K. Raman, Computers in Chemistry, McGraw Hill Education, Revised edition (2002).

Reference Books:

1. F. Albert Cotton, G. Wilkinson, Paul L. Gaus, Basic Inorganic Chemistry, Wiley, 3rd edition (1995).
2. J.D. Lee, Concise Inorganic Chemistry, Oxford University Press, 5th edition (2008).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, Organic Chemistry, John Wiley & Sons, 12th edition (2014).
4. G.W. Castellan, Physical Chemistry, Narosa Publications, 4th edition Narosa (2004).
5. R.T. Morrison and R. N. Boyd, Organic Chemistry Prentice-Hall of India Ltd, New Delhi, 6th edition (1992).
6. S. Glasstone and D. Lewis, Elements of Physical Chemistry, Macmillan, 2nd edition (1960).
7. Gurtu, Snehi, Advanced Physical Chemistry, Pragati Prakashan Publishing, 7th edition (2004).

E-references:

1. https://hemantmore.org.in/foundation/science/chemistry/theory-acids-bases/3510/
2. http://ncert.nic.in/ncerts/l/lech203.pdf

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4
CO1	S	H	H	S
CO2	S	M	S	S
CO3	M	S	H	S
CO4	H	S	S	M
CO5	S	S	H	S

S - Strong; **H -** High; **M -** Medium; **L -** Low

Programme Code:	B.Sc.	**Programme Title:**	Chemistry	
Course Code:	19UBPH03	**Course Title:**	**Batch:**	2019
Total Hours:	90	Physics	**Semester:**	III
			Credits:	3.0

Course Objective

The course aims

- To impart fundamental knowledge in the area of Physics.
- To acquire knowledge in elastic, viscous and thermal properties of matters.
- To understand the concept of ultrasonics, transmission of heat and lasers.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1, K2, K3, K4, K5	**CO1**	Apply knowledge of properties of matter to explain behavior of materials under different circumstances and related technological advances.
	CO2	Understand the action of gravitational fields on different objects and the properties & applications of ultrasonic waves.
	CO3	Learn the application of Joule Thompson effect in the liquefaction of gases and understand the heat transfer mechanisms.
	CO4	Demonstrate an understanding of the application perspectives of heat radiation and lasers.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Elasticity:** stress - strain - Hooke's law – stress - strain diagram - three moduli of elasticity – Poisson's ratio – bending of beams – expression for the bending moment - experimental determination of Young's modulus by uniform and non-uniform bending method - torsional pendulum – Determination of Rigidity modulus of a wire. **Viscosity:** Coefficient of viscosity – streamline and turbulent flow - Critical velocity - Reynolds' number - Poiseuille's formula for low viscous liquid – experimental determination of viscosity of a liquid – Poiseuille's method.	**18**
II	**Gravitation:** Kepler's Law of Motion – Law of Gravitation – Newton's Universal law of Gravitation – Determination of G by Boy's method – Gravitational Potential – Gravitational Intensity – Gravitational potential and Intensity due to a solid sphere. **Ultrasonics:** Introduction – properties of ultrasonic waves – generation of ultrasonic waves: Magnetostriction method - Piezo electric method – detection of ultrasonic waves. Applications of ultrasonic waves: sonar and general applications.	**18**
III	**Liquefaction of Gases:** Joule – Kelvin porous plug experiment – Temperature of Inversion – relation between Boyle temperature, temperature of Inversion and Critical temperature - Principle of Regenerative cooling - Liquefaction of air: Linde's process - Liquefaction of hydrogen - Liquefaction of Helium – Properties of Liquid Helium. **Thermal Physics:** Conduction – Convection – Radiation- Coefficient of thermal conductivity – Temperature gradient – Dimensional formula – Thermal Diffusivity- Lee's Disc method of determining the thermal conductivity of a bad conductor –	**18**

	Forbes method of determining the thermal conductivity of a good conductors – Practical applications of conduction of heat.	
IV	**Transmission of Heat:** Black Body - Kirchoff's Laws of heat radiation and its proof – Verification of Kirchoff's results: Ritche's Experiment. Prevost theory of Heat Exchange – Lummer and Kurlbham Bolometer – Boy's Radio micrometer – Stefan's law of Radiation – Experimental verification of Stefan's law – Determination of Stefan's constant – laboratory method - Disappearing filament optical Pyrometer. Distribution of Energy in the thermal spectrum of a black body – Lummer and Pringsheim Experiment and its Results – Wien's Displacement Law and Radiation Law – Rayleigh Jean's Law – Planck's Radiation Law - Deduction of Wien's Law and Rayleigh-Jean's Law from Planck's Law. Solar constant – Temperature of the Sun - Pyrheliometers: Angstrom Pyrheliometer – Water flow Pyrheliometer.	**18**
V	**Lasers:** Einstein's prediction – spontaneous emission – stimulated emission – Einstein's A and B coefficients – population inversion. Components of lasers: active medium – pumping – pumping mechanisms – resonant cavity. Characteristics: Directionality – intensity – coherence – monochromaticity. Types of lasers: principle, construction, working, energy level diagram and applications of He-Ne laser - CO_2 laser –Nd:YAG laser – semiconductor laser – Holography.	**18**

<* - *Self Study: Applications of convection, Thermos flask, Acoustic grating*>.

Text Books:

1. Brijlal and Subramaniam, Properties of matter, Chand & Company Ltd., New Delhi, 2002.
2. R.Murugesan and Kiruthiga Sivaprasath, Properties of Matter, Chand & Company Ltd., New Delhi, 2012.
3. Brijlal, N. Subrahmaniam and P.S.Hemne, Heat Thermodynamics and Statistical Physics, 2018 edition, S. Chand & Company Ltd., New Delhi.
4. Sathya Prakash Swati Saluja, Quantum Mechanics, Kedar Nath Ram Nath & Co, Meerut, 2002.

Reference Books:

1. D S Mathur, Elements of Properties of Matter, 5th edition, S Chand & Company Ltd., New Delhi, 2012.
2. J B Rajam and C L Arora, A Text Book of Heat & Thermodynamics, S. Chand & Company Ltd., New Delhi.
3. B.N. Sankar and S.O.Pillai, A text book of engineering physics, New age international publishers, New Delhi, 2007.
4. M N Avadhanulu, P S Hemne, An Introduction to Lasers, 1st edition, S Chand & Company Ltd., New Delhi, 2012.

E-references:

1. https://hemantmore.org.in/science/physics/gravitational-potential/8336/
2. https://opentextbc.ca/physicstestbook2/chapter/viscosity-and-laminar-flow-poiseuilles-law/
3. https://www.khanacademy.org/science/physics/fluids/fluid-dynamics/a/what-is-bernoullis-equation?utm_account=Grant&utm_campaignname=Grant_Science_Dynamic&gclid=EAIaIQobChMI9dGjx4-24QIVTh0rCh1V0Q0KEAAYASAAEgLFZ_D_BwE
4. https://www.explainthatstuff.com/piezoelectricity.html
5. https://www.khanacademy.org/science/chemistry/thermodynamics-chemistry/internal-energy-sal/a/heat
6. https://opentextbc.ca/physicstestbook2/chapter/thermal-expansion-of-solids-and-liquids/
7. http://www.daviddarling.info/encyclopedia/P/porous_plug_experiment.html
8. http://home.iitk.ac.in/~gtm/thermodynamics/lecture14/14_2.htm
9. https://www.emedicalprep.com/study-material/chemistry/states-of-matter/liquefaction-of-gases/

10. https://phys.libretexts.org/Bookshelves/University_Physics/Book%3A_University_Physics_(OpenStax)/Map%3A_University_Physics_III__Optics_and_Modern_Physics_(OpenStax)/06%3A_Photons_and_Matter_Waves/6.02%3A_Blackbody_Radiation
11. https://www.toppr.com/ask/question/state-kirchhoffs-law-of-radiation-and-prove-it-theoretically/
12. https://ocw.mit.edu/resources/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/laser-fundamentals-i/

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO4
CO1	H	S	H	S	S
CO2	M	H	S	S	H
CO3	S	H	S	S	M
CO4	H	S	S	S	H

S - Strong; **H -** High; **M -** Medium; **L -** Low

Programme Code:	B.Sc.	Programme Title:	Chemistry	
Course Code:	19UACH04	Course Title:	Batch:	2019
Total Hours:	75	General Chemistry – IV	Semester:	IV
			Credits:	4.0

Course Objective

The course aims

- To understand the basic properties of d-block elements.
- To learn the basic chemical and structural features of phenols and oxidation of alcohols.
- To learn the basic knowledge in phase equilibrium.

Course Outcome

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1	CO1	Create the knowledge about the properties of d-block elements.
K2	CO2	Acquire an idea about inner transition elements.
K3	CO3	Predict the mechanism of various named reactions of phenol.
K3	CO4	Select the path way for oxidation & preparation of aliphatic amines.
K4	CO5	Analyze the knowledge in liquid-liquid equilibria.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Transition metals (d-block elements):** General characteristics of first, second and third transition series – Metallic character, atomic and ionic radii – oxidation states, colour, complex formation, catalytic and magnetic properties-Non-stoichiometric compounds. Extraction and properties of Vanadium, Chromium, Iron, Copper and zinc. Preparation and properties of $KMnO_4$ and $K_2Cr_20_7$. Important compounds of transition metals: Ziegler – Natta catalyst, Prussian blue, sodium nitroprusside, Turnbull's blue, Nickel-DMG complex, Wilkinson's Catalyst.	**15**
II	**Inner transition elements:** Lanthanides – General characteristics of lanthanides – electronic structure – oxidation state – color and spectra – magnetic properties – lanthanide contraction- isolation of lanthanides by ion – exchange Method and solvent extraction method. **Actinides:** General properties – oxidation state – electronic configuration – actinide contraction – Transactinide elements-IUPAC naming – Extraction and uses of thorium and uranium.	**15**
III	**Phenols:** Acidity of Phenol, explanation on the basis of the resonance stabilization, preparation and reactions of monohydric phenol with mechanism - alkylation, acylation. Mechanism of Kolbe, Reimer-Tiemann, Gattermann, Houben-Hoesch reactions. **Di and trihydric phenols**: preparation and properties of catechol, resorcinol, phloroglucinol.	**15**
IV	**Oxidation of alcohols**: Jones reagent, Pyridinium Chloro chromate (PCC), Pyridinium dichromate (PDC), DMSO, DCC. Oxidative cleavage of 1,2–diols – Lead tetra acetate and periodic acid.	**15**

	Preparation, properties and uses of Nitromethane, Nitrobenzene and Diazomethane. Aliphatic amines: Preparation-reduction of alkyl cyanide, nitro compounds, Hoffmann degradation, Gabriel synthesis and curtius degradation. Separation of mixture of amines-Hoffmann and Hinsberg method. Properties of primary, secondary and tertiary amine.	
V	**Liquid-Liquid equilibria of completely miscible liquids:** temperature composition diagram, temperature vapour pressure diagram, azeotropes, fractional distillation, fractionating columns. **Partially miscible liquid system:** Phenol/water, Triethylamine /Water and Nicotine/Water systems. Completely immiscible liquids-steam distillation.	**15**

<* - ***Self study: Comparison between lanthanides and actinide***>**.**

Text Books:

1. P.L. Soni, Text book of inorganic chemistry, Sultan Chand & Sons, 20th revised edition (1992).
2. R.D. Madan, Modern inorganic chemistry, 3rd revised edition, S. Chand Publishing (2002).
3. B.S. Bahland Arun Bahl, Advanced organic chemistry, S. Chand and Company Ltd. (2014).
4. M.K. Jain and S.C. Sharma, Modern organic chemistry, 4th revised edition, Vishal Publishing Co (2015).
5. Puri, Sharma & Pathania, Principle of Physical chemistry, Vishal Publishing Co (2009).

Reference Books:

1. J.D. Lee, Concise of inorganic chemistry, London New York Chapman and Hall, 5th edition (2008).
2. I.L. Finar, Organic chemistry, Vol I&II, 5th edition, Pearson (2017).
3. Peter Atkins, Physical chemistry, 10th edition, Oxford publication (2017).

E-references:

1. https://www.askiitians.com/iit-jee-chemistry/general-properties-of-the-transition-elements-d-block/
2. https://study.com/academy/lesson/phenol-preparation-reactions.html

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4
CO1	S	H	H	S
CO2	H	S	H	S
CO3	H	S	S	S
CO4	S	S	H	H
CO5	S	H	S	S

S - Strong; **H -** High; **M -** Medium; **L –** Low

Programme Code:	B.Sc.	Programme Title:	Chemistry	
Course Code:	19UACHP2	Course Title:	Batch:	2019
Total Hours:	45	Major Core Practical - II : Volumetric Analysis	Semester:	IV
			Credits:	3.0

Course Objective

The course aims

- To acquire the quantitative skills in volumetric analysis.
- To demonstrate their laboratory skills and problem solving ability.

Course Outcome

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K4, K5	CO1	Apply the techniques involved in volumetric analysis with importance on solution preparation and chemical calculations.
K5	CO2	Evaluate a volumetric titrations, standardization procedure, endpoint detection and emphasizing indicators.
K4, K5	CO3	Analyze experimental results based on the value of the percent error and the possible sources of error.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
	Volumetric Analysis **1. Acidimetry–alkalimetry** i. Estimation of Na_2CO_3 ii. Estimation of $NaHCO_3$ and Na_2CO_3 mixture **2. Permanganometry** i. Estimation of oxalic acid ii. Estimation of ferrous ion **3. Dichrometry:** i. Estimation of ferrous ion using internal indicator ii. Estimation of ferric ion **4. Iodimetry:** Estimation of copper **5. Complexometry** i. Estimation of Zn using EDTA ii. Estimation of Mg using EDTA iii. Estimation of Ca using EDTA iv. Estimation of total hardness of water	**45**

Text Books:

1. V. Venkateswaran, R. Veerasamy and A.R. Kulandaivelu, Basic principles of Practical Chemistry, Sultan Chand and Sons, 2nd edition (1997).
2. P.K. Mani and A.O. Thomas, Textbook For Practical Chemistry for B.Sc. Main students, Xavier press, Cannanore (2003).
3. D.N. Bajpai, O.P. Pandey and S. Giri, Practical Chemistry, S. Chand and Sons, Revised edition (2006).

Reference Books:

1. J. Mendham, Vogel's Quantitative Chemical Analysis, Pearson Education; 6th edition (2009).
2. V.K. Ahluwalia, S. Dhingra, A. Gulati, College Practical Chemistry, Universities Press (India) Limited (2012).

E-references:

1. http://ncert.nic.in/ncerts/l/lelm107.pdf
2. https://slideplayer.com/slide/4239943/

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4
CO1	S	S	H	S
CO2	H	S	S	H
CO3	S	S	S	H

S - Strong; **H** - High; **M** - Medium; **L –** Low

Programme Code:	B.Sc.	Programme Title:	Chemistry	
Course Code:	19UACHP3	Course Title:	Batch:	2019
Total Hours:	45	Major Core Practical - III : Organic Qualitative Analysis	Semester:	IV
			Credits:	3.0

Course Objective

The course aims

- To analyze the organic compounds.
- To improve the practical skill in the preparation of organic compounds.

Course Outcome

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K4	CO1	Identify the various functional groups in organic substances.
K4, K5	CO2	Prepare a suitable derivative of organic compounds.
K5	CO3	Design and synthesis the simple organic molecules.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
	Organic analysis & preparation of organic Compounds Characterization of organic compounds by their functional groups and confirmation by preparation of derivatives. **<u>The following organic substances to be given</u>** Carbohydrates Phenols Aromatic and aliphatic acids (Mono and Di-succinic and phthalic) Esters Aromatic nitro compounds Aromatic amines Aromatic and aliphatic amides (Mono and Diamides-Urea) Aromatic aldehydes and ketones (acetophenone, benzophenone) Preparation involving Oxidation (Benzaldehyde to benzoic acid) Hydrolysis (Ethyl benzoate to Benzoic acid, Benzamide to benzoic acid) Bromination Acetylation	**45**

Text Books:

1. V. Venkateswaran, R. Veerasamy and A.R. Kulandaivelu, Basic principles of Practical Chemistry, Sultan Chand and Sons, 2nd edition (1997).
2. P.K. Mani and A.O. Thomas, Textbook For Practical chemistry for B.Sc. Main students, Xavier press, Cannanore (2003).
3. D.N. Bajpai, O.P. Pandey and S. Giri, Practical chemistry, S. Chand and Sons, Revised edition (2006).

Reference Books:

1. Gnanapragasam and Ramamurthy, Organic chemistry lab manual, Viswanathan S. Printers and publishers Pvt, Ltd. (2009).
2. B.S. Furniss, A.J. Hannaford, P.W.G. Smith and A.R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, 5th edition, Pearson Education Ltd. Singapore (2004).
3. V.K. Ahluwalia, S. Dhingra, A. Gulati, College Practical Chemistry, Universities Press (India) Limited (2012).

E-references:

1. http://ncert.nic.in/ncerts/l/lelm107.pdf
2. https://slideplayer.com/slide/4239943/

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4
CO1	S	S	H	S
CO2	H	S	S	H
CO3	S	S	S	H

S - Strong; **H -** High; **M -** Medium; **L –** Low

Programme Code:	B.Sc.	Programme Title:	Chemistry	
Course Code:	19UACHP4	Course Title:	Batch:	2019
Total Hours:	30	Major Core Practical – IV : Computer Applications in Chemistry	Semester:	IV
			Credits:	2.0

Course Objective

The course aims

- To develop computer knowledge.
- To develop computer program.
- To know the internet application in chemistry.

Course Outcome

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K4	CO1	Demonstrate the utility of computer in chemistry.
K5	CO2	Compute 'C' program in chemistry.
K5	CO3	Formulate the database & Excel programme in chemistry.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
	Computer Applications in chemistry: 1. Program to compute Molarity and Normality of a solution. 2. Program to convert Fahrenheit to Centigrade. 3. Program to calculate the molecular weight of a molecule. 4. Program to calculate the average velocity and RMS velocity. 5. Entering data using windows excel and drawing graphs – Line graphs, Bar graph, Pie chart. 6. Chemical inventory system – using database for tracking chemicals and supplies. 7. Chemical structure and information database – applications. 8. Chem office – Drawing, modeling and Information. 9. Molecular modeling program. 10. 10. Internet applications for chemistry.	**30**

Text Books:

1. Kishor Arora, Computer application in chemistry, Anmol Publications Pvt. Ltd. (2004).
2. Ramesh Kumari, Computer & their applications in chemistry, Alpha science International Ltd. (2002).

Reference Books:

1. K.V. Raman, Computer in chemistry, Tata Mcgraw Hill Publishing Company Ltd. (2000).
2. Stephen Wilson, Chemistry by computers, Plenum Press (2012).

E-references:

1. https://cboard.cprogramming.com/c-programming/130064-calculation-c-program.html
2. http://chemlab.truman.edu/data-analysis/guide-to-excel/

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	S
CO2	S	H	H	H
CO3	H	S	S	H

S - Strong; **H -** High; **M -** Medium; **L –** Low

Programme Code:	B.Sc.	Programme Title:	Chemistry	
Course Code:	19UBPHP2	Course Title:	Batch:	2019
Total Hours:	90	Allied Core Physics Practical	Semester:	IV
			Credits:	2.0

Course Objective

The course aims

- To understand the physical phenomena and fundamentals of general physics.
- To acquire the practical knowledge in the area of mechanics, properties of matter, optics, electricity and magnetism.
- To validate the practical result with theory.

Course Outcome

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1, K2, K3, K4, K5	CO1	Ability to develop basic experiments and analyze the relation between theory and experimental results.
	CO2	Plan the experimental procedure, record and interpret the results.
	CO3	The hands on exercises to apply physics principles to evaluate physical parameters.
	CO4	Compute the experimental investigations of mechanical, heat and optical physics.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate

SYLLABUS
(COVERING SEMESTER – III & IV)

Expt. No.	Content	No. of Hours
	Any Sixteen Experiments:	**90**
1	Young's modulus – Non uniform bending – Pin & Microscope.	
2	Young's modulus – Uniform bending – Pin & Microscope.	
3	Young's modulus – Static Cantilever.	
4	Rigidity modulus – Static Torsion.	
5	Rigidity modulus – Torsional Pendulum.	
6	Y, n & σ Searle's method.	
7	Acceleration due to gravity – Compound Pendulum.	
8	Specific heat of a liquid – Cooling Method.	
9	Thermal conductivity – Lee's Disc Method.	
10	Joule's Calorimeter.	
11	Sonometer – A.C. Frequency.	
12	Spectrometer – Solid Prism.	
13	Spectrometer – Hollow Prism.	
14	Spectrometer – Grating – Minimum Deviation.	
15	Newton's Rings – Radius of Curvature.	
16	Air Wedge – Thickness of a wire.	

17	Meter Bridge – Specific Resistance.	
18	Meter Bridge – Temperature Co-efficient.	
19	Potentiometer – Ammeter – Calibration.	
20	Potentiometer – Low Range –Voltmeter – Calibration.	
21	Moment of magnet – TanC Position.	
22	Moment of magnet – Circuit Coil.	
23	Characteristics of Junction & Zener Diodes.	
24	Verification of Truth Tables of Logic Gates: AND, OR, NOT, NAND and NOR.	
25	Verification of Demorgan's theorems – digital ICs.	

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	H
CO2	H	S	M	S	S
CO3	S	S	S	S	S
CO4	H	M	S	S	S

S - Strong; **H -** High; **M -** Medium; **L –** Low

Question Paper Pattern

(Common for Major, Allied, Allied Optional and Major Optional Papers)

For EOS Examinations: 70 Marks

The Question Paper is to be divided into THREE Sections.

Section-A Carries 15 Marks, Section-B Carries 25 Marks and Section-C Carries 30 Marks.

Section-A Contains 15 Multiple Choice Questions. (15 x 1 = 15 Marks)

Three Questions from each unit. (Q. No: 1 to 15)

Section-B Contains 5 Either or Choice Questions. (5 x 5 = 25)

Each Question carries 5 Marks. Both (a) and (b) from the same unit.

Q. No.: 16 (a) or (b) to 20(a) or (b)

Section-C Contains 5 Questions out of which, 3 Questions are to be answered. (3 x 10 = 30)

Each Question carries 10 Marks. One Question from each unit. Q. No.: 21 to 25

For CIA Examinations: 30 Marks

Section-A: 10 Multiple Choice Questions. (10 x 1 = 10)

Section-B: Two Questions out of Three. (2 x 5 = 10)

Section-C: One Question out of Two. (1 x 10 = 10)

Programme Code:	ALL U.G.	Programme Title:	Allied Optional	
Course Code:	20UDCH01	Course Title:	Batch:	2020
Total Hours:	90	General Chemistry - II	Semester:	IV
			Credits:	5.0

Course Objective

The course aims

- To learn about the basic concepts in lipids, amino acids and proteins.
- To study about the carbohydrates, fertilizers, glass, soaps and detergents.
- To understand the basic concepts of thermodynamics and chromatography.

Course Outcome

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1	CO1	Discuss the concepts of Lipids, Amino acids and Proteins.
K2	CO2	Predict the importance of Fertilizers, Glass, Soaps and Detergents.
K3	CO3	Outline the nature of dyes and formulate chromatography.
K4	CO4	Interpret thermodynamics and thermochemistry.
K2	CO5	Explain carbohydrates.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Lipids**: Definition, classification and properties – physical and chemical – Biological roles – qualitative and quantitative tests for lipids. **Amino acids and proteins**: Classification – synthesis – properties of amino acids – polypeptides – proteins – classification and structure. Test for proteins.	18
II	**Fertilizers: C**lassification – requisites of good fertilizers – preparation of urea, ammonium sulphate, superphosphate of lime and triple superphosphate – mixed fertilizers. **Glass**: Raw materials and manufacture – composition and uses of soda glass, pyrex glass and safety glass. Soaps – raw materials – definition of soap – manufacture by continuous hot process – cleaning action of soap. Detergents – definition – classification with one example each (manufacture not necessary) – difference between soaps and detergents.	18
III	**Dyes**: Colour and constitution: chromophores and auxochromes – Classification based on structure and mode of dyeing, use of mordents – Preparation and uses of congo-red, malachite green, indigo and alizarin. **Chromatography**: Introduction, principle and applications - Column, paper and thin layer chromatography.	18
IV	**Thermodynamics and thermo chemistry**: statement of first law of thermodynamics – mathematical expression and limitations. Enthalpy of system – heat capacity at constant volume and at constant pressure – relationship between Cp and Cv. Statement of second law of thermodynamics. Entropy as a thermodynamic function. Dependence of entropy on temperature,	18

	pressure and volume –Gibbs Helmotz free energy. Thermochemical equations – Hess's law of heat summation – application – bond energy and calculations. Kirchoff's equation.	
V	**Carbohydrates:** Definition and classification: Monosaccharides – Open structure, Haworth or cyclic structure and reactions of glucose and fructose (configuration not necessary). Disaccharides – classification – sucrose, lactose and maltose – occurrence, structure and properties. Polysaccharides: Occurrence, structure and functions of starch and cellulose (structural elucidation not necessary).	**18**

<* - ***Self study: Effects of fertilizers on environment***>.

Text Books:

1. Dr. V. Veraiyan, Text book of Allied chemistry.
2. B.R. Puri, L.R. Sharma and Madan S. Pathania, Principles of Physical Chemistry, Vishal Publications (2010).
3. Gurudeep Raj, Advanced Inorganic Chemistry (Vol-I), Krishna Prakasam Media (P) Ltd. 25th edition (1999).
4. U. Sathyanarayana, U. Charapani, Biochemistry, Books and Allied (P) Ltd.
5. B.S. Bahl and Arun Bahl, Advanced organic chemistry, S. Chand and Company Ltd. (2014).

Reference Books:

1. Gurdeep R. Chatwal and S.K. Anand, Instrumental methods of Chemical Analysis, Himalaya Publishing House (2003).
2. R. D. Madan, Modern Inorganic Chemistry, S. Chand and Company (2013).
3. M. K. Jain and S. C. Sharma, Modern Organic Chemistry, Vishal Publications (2017).
4. J. L. Jain, Fundamentals of Biochemistry, S. Chand and Company.
5. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 4th& 5th editions, Wiley Interscience (1998).

E-references:

1. https://en.wikipedia.org/wiki/Fertilizer
2. https://nptel.ac.in/courses/102103044/pdf/mod5.pdf

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4
CO1	S	M	H	M
CO2	H	M	M	M
CO3	S	H	M	H
CO4	H	H	S	M
CO5	M	H	M	M

S - Strong; **H** - High; **M** - Medium; **L –** Low

Programme Code:	ALL U.G.	Programme Title:	Allied Optional	
Course Code:	19UDCH02	Course Title:	Batch:	2019
Total Hours:	90	General Chemistry - III	Semester:	IV
			Credits:	5.0

Course Objective

The course aims

- To learn about the basic concepts in electrochemistry, corrosion and batteries.
- To study about water treatment and chromatography.
- To understand the chemistry of fuels and industrial gas.

Course Outcome

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1	CO1	Compile various types of electrodes in electrochemistry.
K2	CO2	Compare and uses of the different types of batteries.
K3	CO3	Analyze types of corrosion and its control methods.
K4	CO4	Evaluate hardness of water and the methods of removal of salts.
K2	CO5	Discuss the antiknocking compounds and demonstrate various chromatographic methods.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Electrochemistry:** Types of electrodes – electrode potential – salt bridge – cell reaction – cell representation – silver – silver chloride electrode – calomel electrode – determination of single electrode potential. Glass electrode – measurement of pH using glass electrode. Concentration cells (electrode and electrolyte) – difference between electrochemical and electrolytic cells. Potentiometry – potentiometric titration – redox titration.	18
II	**Batteries and Fuel cells:** Electrochemical energy storage: cell reaction, thermodynamics parameters, polarization, heat effects. Types of batteries - primary batteries, rechargeable batteries - Lead-acid, Ni/Cd, Ni/metal hydride - Lithium ion batteries and its applications. Introduction to fuel cells, H_2 and methanol fuel cells.	18
III	**Corrosion:** definition – types of corrosion: chemical and electrochemical corrosion – pilling-bedworth ratio – types of oxide layer (stable, unstable, volatile and porous) – hydrogen evolution and oxygen absorption mechanism for electrochemical corrosion – mechanism for rusting of iron. Types of electrochemical corrosion: Galvanic corrosion – differential aeration corrosion (pitting, waterline and pipeline). Galvanic series – applications. Factors influencing corrosion: nature of metal and environment. Corrosion control methods: sacrificial anode method – impressed current cathodic protection method – electroplating – electroless plating.	18
IV	Hardness of water – classification of hardness (temporary and permanent) – units of hardness (ppm, mg/l, degree Clark, degree French) – expression of hardness in terms	18

	of calcium carbonate equivalence – estimation of hardness by EDTA method – requirements of boiler feed water – disadvantages of using hard water in industrial boilers: scale, sludge, priming, foaming and caustic embrittlement. Removal of dissolved salts from hard water: internal conditioning (carbonate and colloidal methods), external conditioning (ion exchange process, reverse osmosis). Water treatment – aeration, coagulation, sedimentation, filtration.	
V	**Fuels**: Calorific value – requirement of a fuel – types of fuels. Octane number, Cetane number – antiknocking compounds – Lead tetraethyl. Industrial gases: Coal gas, producer gas, water gas, semi water gas – manufacture and industrial application. Bio gas – gobar gas – production, composition – calorific value – renewable nature. Chromatography – Column, paper and thin layer chromatography. Solubility of gas, liquids and solids in liquid – factors affecting solubility. Henry's law.	**18**

<* - ***Self study: Hardness of water, disadvantages of using hard water in industrial boilers***>.

Text Books:

1. Dr. V. Veraiyan, Text book of Allied chemistry, High mount Publishing house.
2. B.R. Puri, L.R. Sharma and Madan S. Pathania, Principles of Physical Chemistry, Vishal Publications (2010).
3. Dr. B.S. Chauhan, Applied chemistry, Vayu Education Ltd. 1st edition.
4. Arun Bahl and B.S. Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd. 5th edition (2014).
5. Jain and Jain, Engineering chemistry, Dhanpat Rai Publishing Company, 14th edition.

Reference Books:

1. Samuel Glasstone, An introduction to electrochemistry, Litton Educational Publishing.
2. P.W. Atkins, J.De. Paula, Atkin's Physical chemistry, Oxford University Press, 8th edition.
3. Gurdeep R. Chatwal and S.K. Anand, Instrumental methods of Chemical Analysis, Himalaya publishing house.
4. B.K. Sharma, Chromatography, Goel publishing house.

E-references:

1. https://www.scribd.com/document/23180395/Engineering-Chemistry-Unit-I-Water-Treatment
2. http://www.engr.uconn.edu/~jmfent/CHEG320_electrochemistry%20lectures.pdf

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4
CO1	S	H	S	H
CO2	H	S	H	S
CO3	S	H	M	H
CO4	S	S	H	S
CO5	H	H	S	S

S - Strong; **H** - High; **M** - Medium; **L** – Low