Annexure – 6a

E.M.G. YADAVA WOMEN'S COLLEGE, MADURAI -14.

(An Autonomous Institution – Affiliated to Madurai Kamaraj University)

(Re –accredited (3rd cycle) with Grade A+ and CGPA 3.51 by NAAC)

TANSCHE - CBCS with OBE

GENERIC ELECTIVE CHEMISTRY

For I B.Sc., Zoology

(w.e.f. 2023– 2024 Batch onwards)

COURSE STRUCTURE

Sem	Part	Course Code	Course Title	Teaching hrs. (Per week)	Duration of exam (hrs)	Marks allotted			Credits
						CIA	SE	Total	
I	III	23OUZOGECH1	**GEC 1:** Chemistry for Biological Sciences -I	4	3	25	75	100	3
		23OUZOGECH1P	**GEC 2:** Chemistry Practical for Biological Sciences -I	2	3	40	60	100	2
II	III	23OUZOGECH2	**GEC 3:** Chemistry for Biological Sciences -II	4	3	25	75	100	3
		23OUZOGECH2P	**GEC 4:** Chemistry Practical for Biological Sciences -II	2	3	40	60	100	2

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Department of Zoology					Class: IB.Sc			
Sem	**Category**	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
I	Generic Elective Course 1	23OUZOGECH1	Chemistry for Biological Sciences -I	3	4	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	**Employability Oriented**	**Entrepreneurship oriented**
✔	✔	

Course Objectives:

- To provide knowledge on basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
- To provide knowledge about nuclear chemistry and industrial chemistry
- To know importance of speciality drugs and separation and purification techniques.

Course Content:

Unit - I : Chemical Bonding and Nuclear Chemistry

Chemical Bonding**:** Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.

Unit - II : Industrial Chemistry

Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.

Unit - III :Fundamental Concepts in Organic Chemistry

Hybridization: Orbital overlap, hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and

bases, electromeric, mesomeric, hyper conjugation and steric- examples. Reaction mechanisms: Types of reactions–aromaticity (Huckel's rule) – aromatic electrophilic substitution; nitration, halogenation, Friedel- Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

UNIT IV

Drugs and Speciality Chemicals

Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.

Unit – V : Analytical Chemistry

Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.

Books for Study:

1. V.Veeraiyan, Text book of Ancillary Chemistry; High mountpublishing house, Chennai, first edition,2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; PriyaPublications, Karur,2006.
3. S.ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand andCompany, NewDelhi, twenty third edition, 2012.
4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninthedition, 2007.

Books for Reference:

1. P.L.Soni,Mohan Katyal,Textbook of Inorganic chemistry; SultanChan and Company, New Delhi, twentieth edition, 2007.
2. B.R.Puri,L.R.Sharma,M.S.Pathania,Textbook Physical Chemistry;V ishal Publishing Co., New Delhi, forty seventh edition, 2018.
3. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

Web Resources / E.Books:

1. https://gascnagercoil.in/wp-content/uploads/2020/12/allied-chemistry-book.pdf
2. https://www.bookswagon.com/book/textbook-biochemistry-medical-students-kannan/9789389034981
3. https://www.gettextbooks.com/isbn/9788121926140/
4. http://www.khake.com/page75.html

Pedagogy

Chalk and Talk, Power Point presentations, Seminar, Group Discussion, Quiz through ICT-Mode

Rationale for nature of Course:

Knowledge and Skill:

Students can gain knowledge about Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Activities to be given:

Lab activity given to students to identify and compare the Colour and Properties of the various substances, Extraction process involved in metallurgical process using chart work method. Assign them case study about agriculture in current era.

Course learning Outcomes (CLOs):

CLO	Course Outcomes Statement	Knowledge according to Bloom's Taxonomy (Upto K level)
CLO1	Gain in-depth knowledge about the theories of chemical bonding, nuclear reactionsand its applications.	K1 to K3
CLO2	Evaluate the efficiencies and uses of various fuels and fertilizers	K1 to K3
CLO3	Explain the type of hybridization, electronic effect and mechanism involved in theorganic reactions	K1 to K4
CLO4	Demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics andartificial sugars.	K1 to K3
CLO5	Explain various methods to identify an appropriate method for the separation ofchemical components.	K1 to K4

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems, Justifying the statement and deriving inferences
K4- Examining, analyzing, presentation and make inferences with evidences

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Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	3	1	1	2	3	2

1-Basic Level 2- Intermediate Level 3- Advanced Level

LESSON PLAN: TOTAL HOURS (60 Hrs)

UNIT	DESCRIPTION	Hrs	MODE
I	Chemical Bonding**:** Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.	12	Chalk and Talk, PPT, group discussion , quiz,on the spot test and Virtual Labs.
II	Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.	12	Chalk and Talk, PPT, group discussion, quiz,on the spot test and Virtual Labs.
III	Hybridization: Orbital overlap, hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric- examples. Reaction mechanisms: Types of reactions–aromaticity (Huckel's rule) – aromatic electrophilic substitution; nitration, halogenation, Friedel- Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.	12	Chalk and Talk, PPT, group discussion , quiz,on the spot test and Virtual Labs

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IV	Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.	13	Chalk and Talk, PPT, group discussion , quiz,on the spot test and Virtual Labs
V	Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.	12	Chalk and Talk, PPT, group discussion, quiz,on the spot test and Virtual Labs.

Course Designer: Dr.M.Sangeetha

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Department of Zoology			Class: I B.Sc					
Semester	**Category**	**Course Code**	**Course Title**	**Credits**	**Hours**	**CIA**	**SE**	**Total**
I	Generic Elective Course 2	23OUZOGECH1P	Chemistry Practical for Biological Sciences -I	2	2	40	60	100

Nature of the Course		
Knowledge and Skill Oriented	**Employability Oriented**	**Entrepreneurship oriented**
✓	✓	

Course Objectives:

- To provide knowledge on the basics of preparation of solutions.
- To obtain knowledge on principles and practical experience of volumetric analysis

Course Content:

VOLUMETRIC ANALYSIS

1. Estimation of sodium hydroxide using standard sodiumcarbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of ferrous sulphate using standard Mohr's salt.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of potassium permanganate using standardsodium hydroxide.
6. Estimation of magnesium using EDTA. Estimation of ferrous ion using diphenyl amine as indicator.

Books for References:

1. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic PrinciplesofPractical Chemistry; Sultan Chand & sons, Second edition, 1997.

Web resources/E-books:

1. **http://allcomputerprograms.blogspot.com/2011/09/estimation-of-ferrous-iron-redox.html**
2. **https://byjus.com/chemistry/titration-of-oxalic-acid-with-kmno4/**

Pedagogy: Chalk and Talk, Group Discussion, Data interpretation and Demonstration

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LESSON PLAN FOR PRACTICAL (Total hours : 30)

S.no	Description	Hours	Mode
1.	Instruction	2	Demonstration , Chalk and Talk, Discussion
2.	Estimation of Na_2CO3 (2)	4	Demonstration , Chalk and Talk, Discussion
3.	Estimation of Mohr's salt (2)	4	Demonstration , Chalk and Talk, Discussion
4.	Estimation of $KMnO_4$ (2)	4	Demonstration , Chalk and Talk, Discussion
5.	Estimation of NaOH (2)	4	Demonstration , Chalk and Talk, Discussion
6.	Estimation of $FeSO_4$ (2)	4	Demonstration , Chalk and Talk, Discussion
7.	Estimation of $C_2H_2O_4$ (2)	4	Demonstration , Chalk and Talk, Discussion
8.	Revision	2	
9.	Model test (2)	2	
	Total	30	

Course Designer: Dr.(Mrs).M.Sangeetha

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Department of Zoology						Class: IB.Sc		
Sem	Category	**Course Code**	**Course Title**	**Credits**	**Contact Hours / Week**	**CIA**	**SE**	**Total**
I	Generic Elective Course 3	23OUZOGECH2	Chemistry for Biological Sciences-II	3	4	25	75	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓		

Course Objectives:

1.To study the nomenclature of coordination compounds.

2.To acquire the knowledge about carbohydrates.

3.To gain the knowledge about Amino Acids and Essential elements of biosystem.

4.To understand the concepts of kinetics and catalysis.

5.To provide fundamentals of electrochemistry and photochemistry

Course Content :

Unit-1 Co-ordination Chemistry and Water Technology: Co-ordination Chemistry**:** Definition of terms - IUPAC Nomenclature- Werner'stheory - EAN rule - Pauling's theory – Postulates - Applications to $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$,$[Co(CN)_6]^{3-}$ Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea) -Applications in qualitative and quantitative analysis.Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques –BOD and COD

Unit-II Carbohydrates: Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructose interconversion. Preparation and properties of sucrose, starch and cellulose.

Unit-1II Amino Acids and Essential elements of biosystem: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins-classification – structure - Colour reactions – Biological functions – nucleosides -nucleotides – RNA and DNA – structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.

Unit-1V Electrochemistry: Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chromeplating – Types of cells -fuel cells-corrosion and its prevention.

Unit-V Photochemistry: Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen -chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).

Books for study :

1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mountpublishing house, Chennai, first edition, 2009.
2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chandand Company, New Delhi, twenty third edition, 2012.
4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; SultanChand & sons, New Delhi, twenty ninth edition, 2007.

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3.P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition,2007.
4.B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventhedition, 2018.
5.B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

Web resources/E-books:

1. **https://www.slideshare.net/ssuserede232/cordination-compound**
2. https://alevelchemistry.co.uk/notes/electrochemical-cells/
3. http://www.bspublications.net/downloads/0523ff2e4a5331_chemistry_ch_01_JNTUK.pdf

4. https://soe.unipune.ac.in/studymaterial/ashwiniWadegaonkarSelf/222%20Chapter%204 . pdf

Pedagogy: Chalk and Talk method, Power point Presentations, Seminar, Group Discussion, Quiz.

Rationale for nature of Course:

Knowledge and Skill: Students can learn about water technology, the chemistry of carbohydrates, nature of corrosion and corrosion preventing methods, learn and handle some chromatographic techniques.

Activities to be given:

Assign students to submit case study on corrosion disasters and preparing ppt on chromatographic techniques.

COURSE LEARNING OUTCOMES(CLOs):

CLOs	Course Outcomes Statement	Knowledge According to Bloom's Taxonomy (Upto K level)
CLO1	Write the IUPAC name for complex, different theories to explain the bonding incoordination compounds and water technology.	K1 to K3
CLO2	Explain the preparation and property of carbohydrate	K1 to K3
CLO3	Enlighten the biological role of transition metals, amino acids and nucleic acids.	K1 to K4
CLO4	Apply/demonstrate the electrochemistry principles in corrosion, electroplating andfuel cells.	K1 to K3
CLO5	Outline the various type of photochemical process	K1 to K4

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems, Justifying the statement and deriving inferences
K4- Examining, analyzing, presentation and make inferences with evidences

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Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6
CLO1	3	1	1	2	3	2
CLO2	3	1	1	1	3	2
CLO3	3	1	1	1	3	2
CLO4	3	1	2	3	3	2
CLO5	2	2	3	2	3	3

1-Basic Level 2- Intermediate Level 3- Advanced Level

LESSON PLAN: TOTAL HOURS (60 Hrs)

UNIT	Details	No. of Hours	Mode of Teaching
I	**Co-ordination Chemistry and Water Technology** Co-ordination Chemistry**:** Definition of terms - IUPAC Nomenclature- Werner'stheory - EAN rule - Pauling's theory – Postulates - Applications to [Ni(CO)4], $[Ni(CN)4]^{2-}$,$[Co(CN)6]^{3-}$ Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis.Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method- Purification techniques –BOD and COD.	**12**	Chalk and Talk, PPT, group discussion, quiz, on the spot test andVirtual Labs.
II	**Carbohydrates** Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructose interconversion. Preparation and properties of sucrose, starch and cellulose.	**11**	Chalk and Talk, PPT, group discussion, quiz, on the spot test andVirtual Labs.
III	**Amino Acids and Essential elements of biosystem** Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins- classification – structure - Colour reactions – Biological functions – nucleosides -nucleotides – RNA and DNA – structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.	**12**	Chalk and Talk, PPT, group discussion, quiz, on the spot test andVirtual Labs.
IV	**Electrochemistry** Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention.	**13**	Chalk and Talk, PPT, group discussion, quiz, on the spot test andVirtual Labs.
V	**Photochemistry** Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen -chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis(definition with examples).	**12**	Chalk and Talk, PPT, group discussion, quiz, on the spot test andVirtual Labs.

Course Designer: Dr.(Mrs).M.Sangeetha

Annexure – 6a

Department of Zoology			Class: I B.Sc					
Semester	**Category**	**Course Code**	**Course Title**	**Credits**	**Hours**	**CIA**	**SE**	**Total**
I	Generic Elective Course 4	23OUZOGECH2P	Chemistry Practical for Biological Sciences -II	2	2	40	60	100

Nature of the Course		
Knowledge and Skill Oriented	Employability Oriented	Entrepreneurship oriented
✓		

Course Objectives:

- To provide knowledge on identification of organic functional groups
- To identify different types of organic compounds with respect to their properties.
- To provide knowledge for determination of elements in organic compounds.

Course Content :

Systematic Analysis of Organic Compounds

(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehydeand glucose].

(b) Detection of elements (N, S, Halogens).

(c) To distinguish between aliphatic and aromaticcompounds.

(d) To distinguish – Saturated and unsaturated compounds.

Books for References:

1. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic PrinciplesofPractical Chemistry; Sultan Chand & sons, Second edition, 1997.

Web resources/E-books:

1.**https://byjus.com/chemistry/titration-of-hydrochloric-acid-against-standard-sodium-carbonate/**

2.**https://byjus.com/jee/hardness-of-water-types-and-removal/**

Pedagogy: Chalk and Talk, Group Discussion, Data interpretation and Demonstration

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LESSON PLAN: TOTAL HOURS (30 Hrs)

S.No	Description	Hrs	Mode
1	Instructions	4	Chalk and Talk
2	Detection of special elements, Aromatic and aliphatic nature, Test for saturation and unsaturation	2	Demonstration
3	Identification of functional groups	2	Demonstration
4	Derivative preparation	2	Demonstration
5	Analysis of organic substance -I	2	Chalk and Talk, Discussion, Procedure with illustration
6	Analysis of organic substance -II	2	Chalk and Talk, Discussion, Procedure with illustration
7	Analysis of organic substance -III	2	Chalk and Talk, Discussion, Procedure with illustration
8	Analysis of organic substance –IV	2	Chalk and Talk, Discussion, Procedure with illustration
9	Analysis of organic substance -V	2	Chalk and Talk, Discussion, Procedure with illustration
10	Analysis of organic substance -VI	2	Chalk and Talk, Discussion, Procedure with illustration
11	Revision	4	
12	Model	4	
	Total	30	

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EVALUATION (PRACTICAL)

Internal (Formative): 40 marks

External (Summative) : 60 marks

Total :100 marks

Question Paper Pattern for Internal Practical Examination:40 Marks

Components	Marks
Procedure	10
Experiment	30
Total	**40**

Question Paper Pattern for External Practical Examination (Major):60Marks

S.No	Components	Marks
1.	Procedure	10
2.	Experiment	40
3.	Record book	10
	Total	**60**

In respect of external examinations passing minimum is **35% for Under Graduate** Courses and in total, **aggregate of 40%.**

Latest amendments and revisions as per **UGC** and **TANSCHE** norm is taken into consideration to suit the changing trends in the curriculum. Allotment of Marks for Volumetric Analysis