E.M.G. YADAVA WOMEN'S COLLEGE, MADURAI – 625 014.

(*An Autonomous Institution – Affiliated to Madurai Kamaraj University*)

Re-accredited (**3rd Cycle**) with Grade **A+** & **CGPA 3.51** by NAAC

DEPARTMENT OF CHEMISTRY

CBCS SYLLABUS

BACHELOR OF SCIENCE

PROGRAMME CODE - K

COURSE STRUCTURE

(w.e.f. 2021 – 2022 Batch onwards)

CRITERION - I

1.2.2 Details of Programmes offered through Choice Based Credit System (CBCS) / Elective Course System

Syllabus copies with highlights of contents focusing on Elective Course System

To be Noted:

HIGHLIGHTED	COURSE
	Elective

Annexure-13

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DEPARTMENT OF CHEMISTRY-UG

(w.e.f. 2021 – 2022 Batch onwards)

COURSE STRUCTURE-SEMESTER WISE

Sem	Part	Sub. Code	Title of the paper	Teaching hrs (Per week)	Exam Duration (hrs)	Marks Allotted			Credits
						CIA	SE	Total	
V	III	**21K51**	**Core**: Organic Chemistry	4	3	25	75	100	4
	III	**21K52**	**Core**: Physical Chemistry-I	4	3	25	75	100	4
	III		**Core: Elective I**	4	3	25	75	100	4
		21K5P	**Core**: Major Practical – III* Gravimetric Estimation and Organic Preparations	4	6	40	60	100	5
			Core: Major Practical – IV* Physical Chemistry	4	-	-	-	-	-
		21AP3	**Allied II** : Physics-Electricity and Electronics	4	3	25	75	100	4
			Allied II : Physics Practical-II*	2	-	-	-	-	-
	IV	**21SEK51**	**SBE**: Chemistry of Bio molecules	2	3	25	75	100	2
		214EV5	Environmental Studies	2	3	25	75	100	2
VI	III	**21K61**	**Core**: Organic Chemistry and Spectroscopy	4	3	25	75	100	4
	III	**21K62**	**Core**: Physical Chemistry-II	4	3	25	75	100	4
	III		**Core : Elective II**	4	3	25	75	100	4
		21K61P	**Core:** Major Practical –IV* Physical Chemistry	4	6	40	60	100	5
		21K62P	**Core**: Major Practical – V* Organic Analysis& Estimation	4	6	40	60	100	5
		21AP4	**Allied II** : Physics - Optics	4	3	25	75	100	4

		21AP4P	**Allied II** : Physics Practical-II*	2	3	40	60	100	1
	IV	**21SEK61**	**SBE**: Green and Nano Chemistry	2	3	25	75	100	2
		214VE6	Value Education	2	3	25	75	100	2
	V	**215NS4/ 215PE4**	Extension Activities NSS/ Phy. Education	-	3	25	75	100	1

Electives

Semester V

Elective- I- (Choose any one)

1. Inorganic and Analytical Chemistry - **21KE5A**
2. Chemistry of materials - **21KE5B**

Semester VI

Elective- II- (Choose any one)

1. Inorganic and Applications of Computer in Chemistry **-21KE6A**
2. Diffraction Methods and Applications **-21KE6B**

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(w.e.f. 2021 – 2022 batch onwards)
Core-Elective-I (choice-A)

Title of the paper: Inorganic and Analytical Chemistry

Semester : V	**Contact Hours: 4**
Sub Code : 21KE5A	**Credits : 4**

Objectives:

1. To acquire knowledge about Halogen compounds
2. To understand the fundamental concepts of transition elements
3. To learn about lanthanides and actinides
4. To study the non-aqueous solvents and inorganic polymers
5. To understand the data analysis and thermoanalytical methods

UNIT: I HALOGEN COMPOUNDS: a) Halogen compounds: Electronic configuration, diatomic nature, oxidizing property, electronegativity and electron affinity –Difficulties in the discovery and isolation of fluorine – peculiarities of fluorine – electropositive character of Iodine b) Interhalogen Compounds: Interhalogen compounds: preparation, properties of ClF, ICl, ClF_3, ClF_5, BrF_5 ,IF_5, IF_7 – structure of ICl, ClF_3, IF_5, IF_7- poly halides and pseudo halogens.

UNIT: II TRANSITION ELEMENTS: a) Transition elements –position in the periodic table –general characteristics of d-block elements. b) Occurrence, extraction, properties and uses of titanium, molybdenum and tungsten. c) Chemistry of titanium dioxide, titanium tetrachloride, vanadium pentoxide-ammonium vanadate, ammonium molybdate, molybdenum blue, tungsten oxide and tungsten bronze.

UNIT: III LANTHANIDES AND ACTINIDES: General characteristics of lanthanides and actinides. Lanthanide and actinides, separation by ion-exchange and solvent extraction methods–lanthanide contraction-actinide contraction. Isolation of thorium from monazite

–preparation, properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate. Applications of lanthanides and actinides.

UNIT: IV NON-AQUEOUS SOLVENTS & INORGANIC POLYMERS

a) Non-aqeous solvents: Classification of solvents-general properties of ionizing solvents-chemical reactions-liquid ammonia as solvents-liquid sulphur dioxide as solvents-liquid hydrogen fluoride as solvents. b) Inorganic polymers: Introduction-general properties of inorganic polymers -silicon based polymers-polysilaxane gums and silicon rubber-industrial applications of inorganic polymer.

UNIT: V DATA ANALYSIS AND THERMOANALYTICAL METHODS: a) Data analysis: Introduction-mean –median-precision-accuracy-confidence limits- definition – determinate errors- indeterminate errors-rules for types improving accuracy of data-significant figure-method of least squares. b) Thermoanalytical methods: Introduction-Thermogravimetric analysis (TGA) –principle –thermal analysis of silver nitrate-derivative thermogravimetry(DGA)-factors which influence the thermogram- application of thermogravimetry.

Text Books:

1. Gopalan R. Subramanian P.S. & Rengarajan K. "*Elements of Analytical Chemistry*" S.Chand & Sons , New Delhi, 2003.
2. Madan R.D, "*Modern Inorganic Chemistry*", S.Chand and Company Ltd., New Delhi, 2011.
3. Puri B.R. Sharma L.R. Kalia K.C., "*Principles of Inorganic Chemistry*", Milestone Publishers, Delhi, 2016.

Reference Books:

1. Gurdeep R. Chatwal & Sham K. Anand. "*Instrumental methods of chemical analysis*". Himalaya publishing house, Mumbai, 2002.
2. Lee J.D., "*Concise Inorganic Chemistry*", Fifth Edition, Blackwell Science Ltd., New Delhi, 2003.
3. Malik U. Tuli G.D. & Madan R.L. "*Selected Topics in Inorganic Chemistry*," S.Chand & Company, New Delhi, 2004

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DEPARTMENT OF CHEMISTRY

(w.e.f. 2021 – 2022 Batch onwards)
Core-Elective –I (Choice B)

Title of the paper: Chemistry of Materials

Semester : V **Contact Hours: 4**
Subject Code : 21KE5B **Credits : 4**

Objectives:

1. To understand about structures of solids.
2. To study about preparative method and characterization.
3. To learn the electrical and optical properties.
4. To gain knowledge about magnetic properties.
5. To study the special materials.

UNIT: I STRUCTURES OF SOLIDS : Introduction to solids – Crystalline and amorphous. Unit cell, Bravais lattices and X-ray structure determination (NaCl and KCl only) – powder and single crystal methods. Radius ratio rules – coordination number. Packing arrangement – different structure types in solids – rock salts, zinc blonde, wurtzite, spinel and inverse – spinel and perovskite structures.

UNIT: II PREPARATIVE METHOD AND CHARACTERIZATION: Solid state reactions – ceramic method, sol- gel hydrothermal, high pressure, zone refining, CVD, Czochralski and Bridgman and stockbarger methods. Physical methods – thermogravimetric and differential thermal analysis and scanning electron microscopy (only introduction and applications)

UNIT: III ELECTRICAL AND OPTICAL PROPERTIES: Defects in solid state – point defects – Frenkel and Schottky defects and non-stoichiometric defects. Conductors – variation of conductivity with temperature – semiconductors – p and n types, pn-junction, photoconduction, photo voltaic cell and photogalvanic cell – solar energy conversion,

organic semiconductors. Piezoelectric, pyro-electric and ferroelectrics (introduction and applications) Photolumionescence.

UNIT:IV MAGNETIC PROPERTIES: Magnetic properties – classification – diamagnetic, paramagnetic, antiferro magnetic, ferro and ferri magnetic – magnetic susceptibility – variation with temperature Curie-Wiess law, Curie temperature and Neel temperature. Permanent and temporary magnets.

UNIT: V SPECIAL MATERIALS: Super conductivity – introduction, Meissner effect – mention of Bardeen, Cooper and Schrieffer theory and Cooper pairs – examples of superconducting oxides, Chevrel phases – applications of superconducting materials. Ionic conductors – sodium-b alumina, sodium-sulphur battery. Intercalation-layered compounds – graphitic compounds. Special applications of solid state materials.High energy battery, lithium cells.

Text Books:

1. Meyers H.P., "*Introductory Solid State Physics*", 2nd Edn, Viva books private Limited, New Delhi, 2009.
2. West A.R., "*Solid State Chemistry and its Applications"*, 2nd Edn, John-Wiley and sons Singapore, 2014.

Reference Books:

1. Emelius H.J. & Sharpe A.G., "*Modern aspects of Inorganic Chemistry*", Universal Book stall, 2010.
2. Greenwood N.N., "*Ionic crystals, Lattice defects and Nonstoichiometry*",Butterworths, London, 2003.
3. Jolly W.L., "*Modern Inorganic Chemistry*", Mc Graw Hill Book Company New York, 1996.
4. Shriver D.F & Atkins P.W., "*Inorganic Chemistry*", Oxford University, Longford, 2008.

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DEPARTMENT OF CHEMISTRY

(w.e.f. 2021 – 2022 Batch onwards)
Core-Elective Paper II (Choice A)

Title of the paper: Inorganic and Applications of Computer in Chemistry

Semester	**: VI**	**Contact Hours: 4**	
Subject code	**: 21KE6A**	**Credits**	**: 4**

Objectives:

1. To learn the fundamentals in coordination compounds and chelates.
2. To understand VBT, CFT and molecular orbital theory.
3. To study metal carbonyls, metal nitrosyls and bioinorganic chemistry.
4. To learn the basics of C-language and its applications in chemistry.
5. To acquire the knowledge in representation and manipulation of 2D, 3D molecular structure using cheminformatics.

UNIT: I COORDINATION COMPOUNDS-I: Double salts and coordination compounds – terminology: coordination sphere, coordination number, ligand and its types – nomenclature – EAN rule -Isomerism: structural isomerism and stereo isomerism Chelates: classification – chelate effect and application of the formation of chelated complexes in analytical chemistry.

UNIT: II COORDINATION COMPOUNDS-II: Werner's coordination theory: postulates and experiment evidence - Sidgwick's concept: EAN rule – applications and limitations - Valence Bond Theory: assumptions and illustration to 4- and 6- coordination ions - hybridization and geometry - limitations - Crystal Field Theory: salient features - orbital splitting as applied to octahedral, tetrahedral and square planar complexes - CFSE and its calculation –factors influencing the magnitude of CF splitting:

nature of central cation, spectrochemical series- magnetic moments and color of transition metal complexes- Comparion of VBT and CFT - Molecular orbital theory :σ bonding in octahedral complexes $[Co(NH_3)_6]^{3+}$ & $[CoF_6]^{3+}$- π bonding system introduction only.

UNIT: III METAL CARBONYLS, METAL NITROSYLS AND BIO- INORGANIC CHEMISTRY: a) Metal Carbonyls: Definition-classification-general methods of preparation and properties of carbonyls-structure and bonding in $Ni(CO)_4$, $Fe(CO)_5$, $Cr(CO)_6$, $Mn_2(CO)_9$, and $Co_2(CO)_8$-EAN rule as applied to carbonyls.b) Metal nitrosyls:Nitrosyls-types-nitrosyls compounds.preparation, properties and structure – sodiumnitroprusside-nitroferrous sulphate-EAN as applied to nitrosyls.

c) Bio-Inorganic Chemistry: Role of metal ions (Fe, Co, Zn, Mg, Na, Ca &K) in biological systems- structure of metallo porphyrins- structure and functions of heamoglobin, myoglobin.

UNIT: IV PROGRAMMING IN C LANGUAGE: a) Advantages- types of the language- keywords- variables and parameters- arrays- data types-structures- funning of C program constants- operators-expressions- input and output- control statements- looping-functions. b) Applying C programme to Calculation of Inversion temperature-Crms, Cav and Cmp velocity- degrees of freedom on the basis of phase rule- efficiency of a heat engine- half-life period of a reaction- critical constants-ionic strength of any electrolytic solutions.

UNIT : V CHEM INFORMATICS: a)Representation and manipulation of 2D molecular structure: Introduction- computer representation of chemical structure- Graph Theoretic Representations of Chemical Structures– connection tables and linear notations- structure searching – substructure searching (screening methods) –reaction databases.

b) Representation and manipulation of 3D molecular structure:Introduction-theoretical 3D databases (structure generation programmes – conformational search & analysis – systematic conformational search – random conformational search).

Text Books:

1. Andrew R., Leach Valerie J. & Gillet, "*An Introduction to Chemoinformatics",* Springer International Edition, 2007.
2. James E.Huheey., Ellen A., Keiter,Richard L.Keiter, Okhil K.Medhi *"Inorganic chemistry principles of structure and reactivity"* 4th edition published by pearson Education, New Delhi, 2016.
3. Madan R.D., "*Modern Inorganic Chemistry*", S.Chand & Co., New Delhi, 2011.
4. B.R. Puri, L.R. Sharma and K.C. Kalia, "*Principles of Inorganic Chemistry*", 31st Edition, Milestone Publishers and Distributors, New Delhi, 2013.
5. Raman K.V., "*Computers in Chemistry*", Tata McGraw-Hill Publising Company, New Delhi, 2004.

Reference Books:

1. Balagurusamy, "*Programming in ANSI C"*, Third Edition, Tata McGraw-Hill Publishing Company, 2019.
2. Chatwal G.R. & Bhagi A.K., "*Bio-Inorganic Chemistry*," First Edition, Himalaya Publishing House, Mumbai, 1996.
3. Kettle S.F, "*Coordination Chemistry*", ELBS and Nelson, 1986.
4. Lee J.D., "*Concise Inorganic Chemistry*," Fifth Edition, Blackwell Science Ltd., New Delhi, 2003.
5. Malik U. Tuli G.D. & Madan R.L. "*Selected Topics in Inorganic Chemistry*," S.Chand & Company, New Delhi, 2004.

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(w.e.f. 2021 – 2022 Batch onwards)
Core- Elective Paper II (Choice -B)

Title of the paper: Diffraction Methods and Applications

Semester : VI	**Contact Hours: 4**
Subject code : 21KE6B	**Credits : 4**

Course Objectives:

1. To learn the Diffraction phenomenon, crystallography.
2. To understand particle structure determination and unit cell, space cell.
3. To study structure analysis and semiconductors.
4. To acquire the knowledge in applications of X-ray diffraction.
5. To learn about neutron diffraction and electron diffraction.

UNIT : I

Diffraction phenomenon – introduction – principles of Diffraction X-rays and crystal-diffraction of particle beams. Single crystal X-rays: X-ray crystallography – single crystals – diffraction from lattices – atoms in lattices – extension of phasing-refinement.

UNIT : II

Particle structure determination – Production of X rays – determining the unit cell and space group – intensity data – data reduction – elucidating the structure – crystallographic results.

UNIT : III

Structure analysis – Growth of X-ray crystallography – inorganic chemistry and mineralogy – metal complexes and covalent molecule – organometallic compounds – metal and semiconductors – organic compounds – biological structures – single crystals work in perspective.

UNIT : IV

Specialized applications of X-ray diffraction – Powder method X-ray diffraction and high polymers degree of crystallinity – orientation – micro and macro structure in polymers – other applications of X-ray diffraction.

UNIT : V

Neutron Diffraction – Diffraction of thermal neutron – elastically scattered neutrons – magnetic scattering of neutrons – inelastic neutron scattering – Electron diffraction – Diffraction from gases and vapours – high energy electron diffraction from solids – low energy diffraction.

Text Book:

1. Wormald J., "*Diffraction Methods*", Oxford series, U.K., 1973.

Reference Books:

1. Ebsworth E.A.V. David W.H. & Rankin Stephen Cradock, "*Structural Methods in Inorganic Chemistry"*, ELBS, Oxford, U.K., 1987.
2. Jolly W.L., "*Modern Inorganic Chemistry*", Mc Graw Hill Book Company New York, 1996