Department of Chemistry and Chemical Sciences
CENTRAL UNIVERSITY OF JAMMU
Rahya-Suchani (Bagla), District-Samba,
Jammu-181143, (J&K) India

CENTRAL UNIVERSITY OF JAMMU
Rahya-Suchani (Bagla), District-Samba,
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Five-year Integrated M.Sc. Chemistry

Teaching Plan (February 2021-June 2021)

Semester: VI
Course: Selected Topics in Inorganic Chemistry (ICCHM6C001T)
Course Teacher: Dr. Swati Sharma

Week	Lecture No./Day	Topic to be Taught	No of Hours	Suggested Readings
1st Week	I	Oxidation and reduction: Oxidation number,	1	1-6
	II	Redox potential, Half-cell reaction,	1	1-6
	III	Nernst equation (without derivation), Electrochemical series,	1	1-6
	IV	Use of redox potential data–Analysis of redox cycle, Redox stability in water,	1	1-6
2nd Week	I	Latimer diagram for oxygen, copper (acidic medium) and for chlorine (acidic/alkaline medium	1	1-6
	II	Contd.	1	1-6
	III	Calculation of E values for skip-step couples using EMF diagrams,	1	1-6
	IV	Frost diagrams for oxygen and nitrogen,	1	1-6
3rd Week	I	Contd.	1	1-6
	II	Pourbiax diagram for iron couple,	1	1-6
	III	Applications of redox reactions to the extraction of elements from their ores: Ellingham diagrams.	1	1-6
	IV	Contd.	1	1-6
4th Week	I	Chemistry of lanthanides elements: Position of lanthanides in the periodic table,	1	1-6
	II	Contd.	1	1-6
	III	Electronic structure,	1	1-6
	IV	Oxidation states,	1	1-6
5th Week	I	Ionic radii	1	1-6
	II	and lanthanide contraction,	1	1-6
	III	Magnetic properties, ,	1	1-6
	IV	Contd.	1	1-6

6th Week	I	spectral properties	1	1-6
	II	Contd.	1	1-6
	III	Chemistry of actinides elements: Position of actinides in the periodic table,	1	1-6
	IV	Electronic structure,	1	1-6
7th Week	I	Oxidation states,	1	1-6
	II	Ionic radii,	1	1-6
	III	Magnetic, and spectral properties,	1	1-6
	IV	Complex formation	1	1-6
8th Week	I	Occurrence and isolation	1	1-6
	II	, Separation of lanthanides: Ion-exchange method,	1	1-6
	III	General features and chemistry of actinides, Principles of separation of Np, Pu and Am from U,	1	1-6
	IV	Application of actinides,	1	1-6
9th Week	I	Trans-uranium elements.	1	1-6
	II	Principles of separation of Np, Pu and Am from U,.	1	1-6
	III	Nuclear chemistry and radioactivity-II: Introduction to radioactivity:	1	7-10
	IV	Radioactive decay and equilibrium,	1	7-10
10th Week	I	Q value, Cross sections,	1	7-10
	II	Radioactive techniques,.	1	7-10
	III	Tracer technique, Neutron activation analysis,	1	7-10
	IV	Counting techniques such as G.M. ionization and proportional counter,	1	7-10
11th Week	I	Radioactive disintegration,	1	7-10
	II	Half life, Average life,	1	7-10
	III	Application of radioactivity and radio isotopes as tracers in analysis,	1	7-10
	IV	in medicines, in biological field, in agriculture	1	7-10
12th Week	I	and in carbon dating	1	7-10
	II	Contd.	1	7-10
	III	General principles of bioinorganic chemistry: A brief introduction to bioinorganic chemistry,	1	5,6
	IV	Classification of elements (essential and trace) according to their action in biological system with special reference to Na^+, K^+ and Mg^{2+} ions,	1	5,6
	I	Contd.	1	5,6

13th Week	II	Generation of concentration gradients (Na^+/K^+ pump),	1	5,6
	III	Nitrogenase,	1	5,6
	IV	Biological nitrogen fixation,	1	5,6
14th Week	I	Chemical nitrogen fixation,	1	5,6
	II	Role of Mg^{2+} ion in energy production and chlorophyll,	1	5,6
	III	Dioxygen transport and storage,	1	5,6
	IV	Hemoglobin	1	5,6
15th Week	I	and Myoglobin-	1	5,6
	II	Electronic and spatial structures,	1	5,6
	III	Contd.	1	5,6
	IV	Stabilization of protein structures and protein role(bones).	1	5,6

REFERENCES

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2. G. L. Miessler and D. A. Tarr, *Inorganic Chemistry*, 3rd Ed., Pearson, 2004.
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Five-year Integrated B.Sc. (Hons.), M.Sc. Chemistry

Teaching Plan (Feb2021-June 2021)

Semester: VI
Course: Bioorganic and Heterocyclic chemistry (ICCHM6C002T)
Course Teacher: Dr. Shahnawaz. Khan

Week	Lecture No./Day	Topic to be Taught	No of Hours	Suggested Readings
1st Week	I	Amino acids, peptides and proteins: Introduction	1	1-4
	II	Classification of Amino acids and their structure	1	1-4
	III	stereochemistry of amino acids, Zwitterions	1	1-4
	IV	Isoelectric point, Electrophoresis	1	1-4
2nd Week	I	ionic properties and reactions of α-amino acids	1	1-4
	II	Synthesis of amino acids	1	1-4
	III	End group analysis and Edman degradation of amino acids	1	1-4
	IV	Introduction and Classification of proteins	1	1-4
3rd Week	I	Peptide structure determination	1	1-4
	II	End group analysis	1	1-4
	III	Selective hydrolysis of peptides	1	1-4
	IV	Solid-phase peptide synthesis	1	1-4
4th Week	I	Primary and secondary structures of proteins.	1	1-4
	II	Reductive amination in nature	1	1-4
	III	nature products made from amino acid metabolism	1	1-4
	IV	Components of nucleic acids, Nucleosides and nucleotides,	1	1-4
5th Week	I	Synthesis of Adenine and Guanine	1	1-4
	II	Synthesis of Cytosine and Uracil	1	1-4
	III	Synthesis of Thymine	1	1-4
	IV	Structure of polynucleotides, Ribonucleosides and Ribonucleotides	1	1-4
6th Week	I	Cyclic nucleosides and stereochemistry	1	1-4
	II	The double helical structure of DNA.	1	1-4
	III	**Lipids**: Introduction to oils and fats,	1	1-4
	IV	Common fatty acids present in oils and fats,	1	1-4
7th Week	I	Hydrogenation of fats and oils,	1	1-4
	II	Saponification value, Acid value, Iodine number	1	1-4
	III	Introduction and Classification of enzymes characteristics of enzymes	1	1-4
	IV	Salient features of active site of enzymes, Mechanism of enzyme action (chymotrypsin)	1	1-4
8th Week	I	Factors affecting enzyme action	1	1-4
	II	Detailed introduction about Coenzymes and cofactors	1	1-4
	III	Coenzymes and cofactors role in biological reactions	1	1-4
	IV	Mechanism of action of carboxypeptidase	1	1-4

9th Week	I	Specificity of enzyme action (including stereospecif - icity)	1	1-4
	II	Enzyme inhibitors	1	1-4
	III	Importance of Enzyme inhibitors	1	1-4
	IV	Mechanism of action of coenzymes	1	1-4
10th Week	I	Class test	1	1-4
	II	**Heterocyclic compounds-I:** introduction about heterocyclic compounds	1	1-4
	III	Classification and nomenclature of heterocyclic compounds	1	1-4
	IV	Methods of formation of five membered heterocycles: Furan	1	
11th Week	I	Methods of formation of five membered heterocycles: Thiophene	1	5-8
	II	Methods of formation of five membered heterocycles: pyrrole	1	5-8
	III	Synthesis Pyrroles thiophenes and furan from 1,4 dicarbonyl compounds	1	5-8
	IV	Paal-Knorr synthesis	1	5-8
12th Week	I	Knorr pyrrole synthesis	1	5-8
	II	Hantzsch synthesis	1	5-8
	III	Aromatic characteristics furan Chemical	1	5-8
	IV	Aromatic characteristics thiophene,	1	5-8
13th Week	I	Chemical reactions of pyrrole, furan and thiophene	1	5-8
	II	Mechanism of electrophilic substitution furan and thiophene	1	5-8
	III	Six membered heterocycles, Methods of formation of pyridine	1	5-8
	IV	Mechanism of nucleophilic substitution reactions in pyridine derivatives	1	5-8
14th week	I	Comparison of basicity of pyridine, piperidine and pyrrole	1	5-8
	II	**Heterocyclic compounds-II:** Introduction to condensed six-membered heterocycles	1	5-8
	III	Preparation and reactions of indole, quinoline and isoquinoline	1	5-8
	IV	Fischer indole synthesis, Skraup synthesis, Friedländer synthesis	1	5-8
15th week	I	Knorr quinoline synthesis, Doebner-Miller synthesis	1	5-8
	II	Bischler-Napieralski synthesis	1	5-8
	III	Pictet-Spengler reaction	1	5-8
	IV	Pomeranz-Fritsch reaction, Madelung synthesis	1	5-8
16th week	I	Revision of units I and II	1	5-8
	II	Revision of units III and IV	1	5-8
	III	Revision of units V	1	5-8
	IV	Discussion of model question papers	1	5-8

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1. D. L. Nelson and M. M. Cox, Lehninger's Principles of Biochemistry, 7th Ed., W. H. Freeman and Company, 2017.
2. J. M. Berg, J. L. Tymoczko, G. J. Gatto Jr. and L. Stryer, Biochemistry, 8th Ed., 2015.
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8. 4. *Comprehensive Heterocyclic Chemistry*, A.R. Katritzky and C.W. Rees (Eds.), Vol IVIII, Ist Ed., Pergamon Press.

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Five-year Integrated M.Sc. Chemistry

Teaching Plan (February 2021-June 2021)

Semester: VI
Course: Spectroscopy and Computational Chemistry (ICCHM6E001T)
Course Teacher: Dr. Tapta Kanchan Roy

Week	Lecture No./Day	Topic to be Taught	No of Hours	Suggested Readings
1st Week	I	Pre-dissociation, Quantum yield and radiative processes,	1	1-5
	II	Fluorescence and phosphorescence,	1	1-5
2nd Week	I	Jablonski diagram, Internal conversion and intersystem crossing.	1	1-5
	II	Basics of photochemistry	1	1-5
3rd Week	I	Generation of excited states, Singlet and triplet states, Spin-orbit coupling	1	1-5
	II	Contd.	1	1-5
4th Week	I	Kinetics of photophysical and photochemical processes, Timescales	1	1-5
	II	Contd.	1	1-5
5th Week	I	The primary quantum yield, Mechanism of decay of excited singlet states	1	1-5
	II	Quenching, Stern-Volmer equation and its applications	1	1-5
6th Week	I	Contd.	1	1-5
	II	Flash photolysis, Laser flash photolysis	1	1-5
7th Week	I	Contd.	1	1-5
	II	Lasers and their applications.	1	1-5
8th Week	I	General introduction to computers	1	1-5
	II	Different components of a computer, Hardware and software, Conceptual background of theory	1	1-5
9th Week	I	Computations and molecular modeling	1	1-5
	II	Z-matrix	1	7, 8, 9
10th Week	I	Contd.	1	7, 8, 9
	II	Potential energy surfaces and chemical properties	1	7, 8, 9
11th Week	I	Cost and efficiency, algorithms,	1	7, 8, 9
	II	Elementary ideas of molecular mechanics and force fields, Parameterization, Potential energy functional forms	1	7, 8, 9
12th Week	I	Contd.	1	7, 8, 9
	II	Conceptual ideas of Molecular orbital methods,	1	7, 8, 9
13th	I	Concept of equilibrium structures, Transition state structures and harmonic frequency calculations, Born-Oppenheimer approximation	1	7, 8, 9

Week	II	Awareness of computational chemistry software	1	7, 8, 9
14th Week	I	Introduction to computer languages	1	7, 8, 9
	II	Programming and operating systems	1	7, 8, 9
15th Week	I	Problem Solving/Numerical	1	1-10
	II	Problem Solving/Numerical	1	1-10

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1. P. W. Atkins and J. de Paula, *The Elements of Physical Chemistry*, Oxford, 10th Ed., 2014.
2. B. R. Puri, L. R. Sharma and M. S. Pathania, *Principles of Physical Chemistry*, Vishal Publishing Co., 47th Ed., 2017.
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Five-year Integrated M.Sc. Chemistry

Teaching Plan (February 2021-June 2021)

Semester: VI
Course: Spectroscopy and Computational Chemistry (ICCHM6E001T)
Course Teacher: Dr. Mukesh Kumar Verma

Week	Lecture No./Day	Topic to be Taught	No of Hours	Suggested Readings
1st Week	I	**Spectroscopy:** Introduction: Electromagnetic radiation, Regions of the spectrum,	1	1-5
	II	Basic elements of practical spectroscopy,	1	1-5
2nd Week	I	Lambert-Beer Law,	1	1-5
	II	Width and intensity of spectral lines,	1	1-5
3rd Week	I	Rotational spectroscopy: Diatomic molecules, Energy levels of a rigid rotor (semi-classical principles),	1	1-5
	II	Selection rules, Spectral intensity,	1	1-5
4th Week	I	Distribution using population distribution (Maxell- Boltzmann distribution),	1	1-5
	II	Rigid diatomic molecule, Non rigid rotator,	1	1-5
5th Week	I	Spectrum of non-rigid rotator, Polyatomic molecules	1	1-5
	II	Determination of bond length, Isotope effect.	1	1-5
6th Week	I	**Vibrational spectroscopy:** Infrared spectrum: Energy levels of simple harmonic oscillator,	1	1-5
	II	Selection rules,	1	1-5
7th Week	I	Pure vibrational spectrum, Intensity,	1	1-5
	II	Determination of force constant and qualitative relation of force constant and bond energies,	1	1-5
8th Week	I	Effect of anharmonic motion and isotope on the spectrum,	1	1-5
	II	Idea of vibrational frequencies of different functional groups,	1	1-5
9th Week	I	Vibration–rotation spectroscopy,	1	1-5
	II	P-branch and R-branch.	1	1-5
10th Week	I	Raman spectroscopy: Concept of polarizability,	1	1-5
	II	Stokes and Anti-Stokes lines	1	1-5
11th Week	I	Pure rotational and pure vibrational Raman spectra of diatomic molecules,	1	1-5
	II	Contd.	1	1-5
12th Week	I	Selection rules, Mutual Exclusion.	1	1-5
	II	Class test-I	1	1-5
13th Week	I	**Electronic spectroscopy:** The characteristics of electronic transitions,	1	1-5
	II	Electronic spectroscopy of atoms,	1	1-5
14th Week	I	Term symbol,	1	1-5
	II	Photoelectron spectroscopy,	1	1-5

15th Week	I	Electronic spectroscopy of molecules,	1	1-5
	II	Selection rules,	1	1-5
16th Week	I	Vibrational structure and Franck-Condon principle, Franck-Condon factor,	1	1-5
	II	Concept of HOMO-LUMO transitions, Simple Dissociation energy,	1	1-5

REFERENCES

1. P. W. Atkins and J. de Paula, *The Elements of Physical Chemistry*, Oxford, 10th Ed., 2014.
2. B. R. Puri, L. R. Sharma and M. S. Pathania, *Principles of Physical Chemistry*, Vishal Publishing Co., 47th Ed., 2017.
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Five-year Integrated M.Sc. Chemistry
Teaching Plan (Feb 2021-June 2021)

Semester: VI
Course: Applied Chemistry (ICCHM6E002T)
Course Teacher: Dr. Shivender Singh Saini

Week	Lecture No./Day	Topic to be Taught	No of Hours	Suggested Readings
1st Week	I	**Polymers:** Monomers and their functionality, Classification,	1	1-2
	II	Degree of polymerization, Type of polymerization,	1	1-2
2nd Week	I	Addition and condensation polymerization	1	1-2
	II	Mechanism of free radical, cationic, anionic and Ziegler-Natta polymerizations,	1	1-2
3rd Week	I	Contd.	1	1-2
	II	Stereochemistry of polymer	1	1-2
4th Week	I	Thermo- and thermosetting plastics	1	1-2
	II	Preparation, properties and uses of Polythene,	1	1-2
5th Week	I	Polystyrene, PVC	1	1-2
	II	Phenol-formaldehydes, Nylons, Kevlar	1	1-2
6th Week	I	Terylene, Rubber: natural and synthetic rubbers, Silicone rubber	1	1-2
	II	Contd.	1	1-2
7th Week	I	**Dyes and paints**: Classification of dyes, Synthetic dyes:	1	5-6,11-12
	II	Methyl orange, Congo red, Malachite green	1	5-6,11-12
8th Week	I	Crystal violet, Primary constituents of a paint, Binders and solvents for paints,	1	5-6,11-12
	II	Contd.	1	5-6,11-12
9th Week	I	Oil based paints, Latex paints, Constituents of varnishes	1	5-6,11-12
	II	Contd.	1	5-6,11-12
10th Week	I	**Soaps and detergents:** Soap action, Raw materials for soaps, Classification and manufacture of soaps,	1	4,6
	II	Contd. Batch process	1	4,6
11th Week	I	Continuous process, Difference between soap and detergent, Active ingredients in detergents, Anionic surfactant, Cationic surfactant,	1	4,6
	II	Amphoteric surfactant and Nonionic surfactant	1	4,6

12th Week	I	Anionic surfactant, Cationic surfactant	1	4,6
	II	Amphoteric surfactant and Nonionic surfactant.	1	4,6

13th Week	I	**Food additives:** Food additives, Definition, Classification, Functions,	1	7, 9-10
	II	Artificial sweeteners, Food flavors, Food colour, Acidulants,	1	7, 9-10
14th week	I	Antioxidants, Alkalies,	1	7, 9-10
	II	Edible emulsifiers and edible foaming agents, Baking powder.	1	7, 9-10
15th week	I	Yeast, Sequesterants, Taste enhancers	1	7, 9-10
	II	Uses and abuses of these substances in food beverages	1	7, 9-10
16th week	I	Revision of Units I		
	II	Revision of Units II and III		

References

1. F. W. Billmeyer, *Textbook of Polymer Science*, John Wiley & Sons, Inc, 3rd Ed., 2007.
2. V. R. Gowariker, N. V. Viswanathan and J. Sreedhar, *Polymer Science*, New Age International (P) Ltd. Pub, 2nd Ed., 2015.
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5. E. Stocchi: *Industrial Chemistry, Vol-I*, Ellis Horwood Ltd. UK, 1990.
6. R. M. Felder and R. W. Rousseau, *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi, 3rd Ed., 2014.
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Five-year Integrated M.Sc. Chemistry

Teaching Plan (February 2021-June 2021)

Semester: VI
Course: **Applied Chemistry** (ICCHM6E002T)
Course Teacher: Dr. M. Karuppasamy

Week	Lecture No./Day	Topic to be Taught	No of Hours	Suggested Readings
1st Week	I	**Cement:** Type of cements, Raw material for manufacture	1	1-3
	II	Manufacture of Portland cement, Manufacturing processes, Dry process, Wet process,	1	1-3
2nd Week	I	Setting of cement, Hydrolysis, Hydration	1	1-3
	II	Properties of cement, Role of gypsum in cement,	1	1-3
3rd Week	I	Special type cements, High alumina cement, White cement, Mortar, Concrete and RCC	1	1-3
	II	Contd.	1	1-3
4th Week	I	Curing and decay of concrete	1	1-3
	II	**Glass:** Physical and chemical properties of glass	1	1-3
5th Week	I	Raw materials, Manufacture of glass by pot and tank furnaces	1	1-3
	II	Types of glass, Tempered glass, Laminated glass,	1	1-3
6th Week	I	Water glass, Optical glass, Borosilicate glass,	1	1-3
	II	Lead glass, Safety glass, Fibre glass, Insulating glass	1	1-3
7th Week	I	**Fertilizers:** Plant nutrients and its role, Classification of fertilizers, Properties of fertilizers	1	1-3
	II	Contd.	1	1-3
8th Week	I	Nitrogenous fertilizers and its manufacture: Ammonium nitrate, Ammonium sulphate, Urea, Calcium cyanamide,	1	1-3
	II	Contd.	1	1-3
9th Week	I	Manufacture of phosphate fertilizer: Normal super phosphate, Triple super phosphate, Mono-ammonium phosphate, Diammonium phosphate, Potassium fertilizer, NPK fertilizer, Bio-fertilizers, Formulation and utilization,	1	1-3
	II	Contd.	1	1-3
10th Week	I	Contd.	1	1-3

	II	**Pesticides and insecticides**: Classification of pesticides with examples and their modes of action	1	1-3
11th Week	I	Contd.	1	1-3
	II	Organic and inorganic pesticides, Biopesticides	1	1-3
12th Week	I	Impact of pesticides on soil, plants and environment	1	1-3
	II	Contd.	1	1-3
13th Week	I	**Food preservation and processing:** Food deterioration	1	4-6
	II	Methods of preservation and processing	1	4-6
14th Week	I	Contd.	1	4-6
	II	Food preservatives, Methods of preservation, Packaging of foods	1	4-6
15th Week	I	Contd.	1	4-6
	II	Revision of Unit IV		
16th Week	I	Revision of Units V and III		
	II	Discussion of model question papers		

REFERENCES

1. E. Stocchi: *Industrial Chemistry, Vol-I*, Ellis Horwood Ltd. UK, 1990.
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