

INORGANIC CHEMISTRY – II

Semester	Subject Code	Category	Lecture Hours		Theory hours		Practical hours		Credits
			Per week	Per sem.	Per week	Per sem.	Per week	Per sem.	
VI		Core – VIII	6	90	6	90	-	-	5

COURSE OBJECTIVES:

The students will be able to

- Gain knowledge about Nuclear chemistry, Structure, Bonding and Photochemistry of Organometallic compounds and the development and uses of Bioinorganic compounds.

COURSE OUTCOMES:

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

CO Number	CO Statement	Knowledge Level (K1-K4)
CO1	Learn about the fundamental concepts of nuclear chemistry, binding energy and nuclear models.	K4
CO2	Understand about natural and induced radioactivity, methods of radioactivity detection, measurement and radioactive disintegration.	K4
CO3	Study artificial radioactivity, uses of radioisotopes, nuclear fission and fusion reactions, atom and hydrogen bomb, nuclear reactor.	K3
CO4	Identify structure, bonding in organometallic compounds and photochemistry of organometallic compounds.	K4
CO5	Understand structure, importance, functions of metalloproteins and metalloenzymes and role of metal ions in biological systems.	K3

*CO – Course Outcomes

Knowledge Level: K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze.

MAPPING WITH PROGRAMME OUTCOMES:

COS	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	S	S	S
CO2	S	S	S	M	S	S
CO3	S	M	S	S	S	S
CO4	S	S	S	S	S	S
CO5	S	S	S	M	S	S

(S – Strong; M – Medium; L – Low)

UNIT-I: Nuclear Chemistry 18 Hours

- 1.1 Introduction – Composition of nucleus – Nuclear forces operating between the nucleons – Fundamental particles of nucleus – Nuclear stability – Mass defect – Nuclear binding energy – The whole number rule and packing fraction – N/P ratio – Magic numbers – Nuclear models – Liquid drop model – Shell model.
- 1.2 Detection and separation of isotopes – Deviation of atomic weights from whole numbers – Isotopes, isobars, isotones and isomers – Radioactive decay and equilibrium – Nuclear isomerism – Internal conversion – Nuclear Q-value – Threshold energy – Cross sections, types of reactions – Modes of radioactive decay.

UNIT – II: Natural Radioactivity

18 Hours

- 2.1 Natural and induced radioactivity – Comparison of nuclear reactions with chemical reactions – Properties of alpha, beta and gamma rays – Radioactive decay – Laws of radioactive decay – Decay constant – Half-life period – Geiger-Nattal rule – Radioactive displacement law – Radioactive techniques.
- 2.2 Natural radioactivity – Detection and measurement of radioactivity – Geiger muller counter and Wilson cloud chamber method – Radioactive series including neptunium series – Group displacement law – K-electron capture and positron emission – Rate of disintegration and half-life period – Average life period.

UNIT – III: Artificial Radioactivity

18 Hours

- 3.1 Artificial radioactivity – Induced radioactivity – Nuclear energy – Nuclear reactors – Nuclear fission and Fusion reactions – Fission chain reaction – Moderators, Coolants, and Neutron absorbers – Atom bomb and Hydrogen bomb – Nuclear energy – Nuclear reactors – Comparison of nuclear fission and fusion reactions – Fission products and Fission yields.
- 3.2 Thermal reactors – Fast breeder reactors – Photonuclear and thermonuclear reactions – Energy source of the sun and stars – Uses of radioisotopes – Carbon dating – Rock dating – Radioactive waste disposal – Applications of nuclear science in agriculture, biology and medicine – Hazards of radiations – Atomic power projects in India.

UNIT-IV: Organometallic Compounds

18 Hours

- 4.1 Organometallic compounds – Definition – Nomenclature of organometallic compounds, 16- and 18- electron rule – Classification – Organolithium and Organo-boron compounds

– Preparation, properties, structure and uses – Structure and bonding in transition metal carbonyls – Introduction – Structure and applications – Metal carbonyls – Polynuclear carbonyls – Bridging and terminal carbonyls – Mononuclear and polynuclear carbonyls of Ni, Fe, Cr, Co and Mn.

- 4.2 Transition metal alkyls – Carbenes, carbynes, and metallocenes – Photochemistry of organometallic compounds – Wilkinson's catalyst and alkene hydrogenation, hydroformylation, Monsanto acetic acid process, Ziegler-Natta catalyst and polymerisation of olefins.

UNIT- V: Bioinorganic Chemistry

18 Hours

- 5.1 Introduction – Transport and storage of oxygen – Structural features of haemoglobin and characteristic features of haemoglobin and myoglobin – Vitamin B₁₂ – Biological functions of haemoglobin, myoglobin, cytochromes and ferredoxins, carbonate-bicarbonate buffering system and carbonic anhydrase – Biological functions of sodium, potassium, iron, copper and zinc.
- 5.2 Structure and functions of metalloproteins and metalloenzymes – Biological nitrogen fixation – Role of chlorophyll in photosynthesis – Photosystem-I and examples – Metal complexes in the human system – Metal complexes in therapy – Significance of chelation in soil biology – Composition, properties and uses of beryl, asbestos, talc, mica, zeolites and ultramarines.

TEXT BOOKS:

S. No.	Authors	Title	Publishers	Year of publication
1.	B. R. Puri, L. R. Sharma, K. C. Kalia	Principles of Inorganic Chemistry	Milestone Publications	2013
2.	R. Gopalan	Textbook of Inorganic Chemistry	Universities Press (India) Private Limited	2012
3.	R. D. Madan	Modern Inorganic Chemistry	S. Chand and Company Ltd.,	2008
4.	P. L. Soni	Inorganic Chemistry	S. Chand and Company Ltd.,	2006
5.	F. A. Cotton and G. Wilkinson	Advanced Inorganic Chemistry	John Wiley and sons	1988

REFERENCE BOOKS:

S. No.	Authors	Title	Publishers	Year of publication
1.	W. U. Malik, G. D. Tuli and R. D. Madan	Selected Topics in Inorganic Chemistry	S. Chand Publications	2008
2.	J. D. Lee	Concise Inorganic Chemistry	New Delhi, Oxford university press	2008
3.	James E. Huheey, Ellen A. Keiter, Richard L. Keiter and Okhil K. Medhi	Inorganic Chemistry: Principles of Structure and Reactivity	Harper Collins, College Publishers, New York	2006
4.	R. L. Madan and J. D. Tuli	Modern Inorganic Chemistry	S. Chand and company Ltd.,	1999
5.	Gurdeep Raj	Advanced Inorganic Chemistry	Goel publishing house	1994
6.	A. K. Srivatsava and P. C. Jain	Element of Nuclear Chemistry	S. Chand and Company Ltd.,	1989
7.	B. K. Sharma	Industrial Chemistry	Goel publications	1983
8.	S. Prakash	Advanced Chemistry of Rare Elements	S. Chand and company Ltd	1982
9.	S. F. A. Kettle	Coordination Chemistry	Published by Nelson and <i>ELBS</i>	1979
10.	K. Burger	Coordination Chemistry	Butterworthy and Co. Publishers Ltd	1973

TEACHING METHODOLOGY:

- Chalk and board teaching
- Power point presentation
- Group discussion
- Seminars
- Assignments