

DEPARTMENT OF CHEMISTRY
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	M.Sc. Chemistry		
Course Title	Main Group, Solid State and Nuclear Chemistry		
Course Code	CH 615	No. of Credits	3
Course Code of Pre-requisite subject(s)			
Session	July 2022	Section (if, applicable)	-
Name of Faculty	Dr. A. Sreekanth	Department	CHEMISTRY
Email	sreekanth@nitt.edu	Telephone No.	9489551851
Name of Course Coordinator(s) (if, applicable)	Dr. A. Sreekanth		
E-mail	sreekanth@nitt.edu		
Course Type	✓ Core course		
Syllabus (approved in BoS)			
<p>Solid state - close packing of atoms and ions - bcc, fcc and hcp voids - structures of rock salt - caesium chloride - wurtzite - zinc blende - rutile - fluorite - antiferite - diamond and graphite - spinel - normal and inverse spinel's and perovskite. Band theory of solids, dislocation in solids: Schottky and Frenkel defects. Electrical properties: Energy bands, insulators, semiconductors and conductors- super conductors.</p> <p>Main Group Chemistry I: Isolobal Analogy- Structure and bonding in polyhedral boranes and carboranes, styx notation; Wade's rule; electron count in polyhedral boranes; synthesis of polyhedral boranes- Wade-Mingos and Jemmis electron counting rules- Heteronuclear clusters- carboranes and heteroboranes -main group metal clusters: Isolobal analogs of p-block clusters</p> <p>Main Group Chemistry II: Boron halides; phosphine-boranes; borazine- phosphorous halides, acids and oxyacids, phosphazenes- sulphur halides, oxo acids of sulphur- structural features and reactivity of reactivity of S-N heterocycles; chemistry of halogens and Noble gases. Synthesis and reactivity of organo-lithium, -beryllium and -magnesium compounds- Organyls of Al, Ga, In and Tl. Silanes, silicon halides, silicates, silanols; germanium, tin and lead organyls.</p> <p>Polyoxometallates: Preparation, properties of isopolyoxo anions – heteropolyoxo anions. Cages and rings formed by the early transition metal elements and metal-chalcogeno anions. Coordination cages – the concept of encapsulation chemistry and confinement driven modified</p>			

reactions.

Nuclear Chemistry: Mass and charge, nuclear moments, binding energy, mass defect, packing fraction, stability, magic numbers. Modes of radioactive decay and rate of radioactive decay-half-life, average life, Energetics and types- nuclear fission- liquid drop model- nuclear fusion-essential features of nuclear reactors- tracer techniques, neutron activation analysis- carbon and rock dating -application of tracers in chemical analysis, reaction mechanisms, medicine and industry.

REFERENCE BOOKS

1. L. V. Azaroff, *Introduction to Solids*, Mc.Graw hill, New York, 1984
2. R. West, *Solid State Chemistry and its Applications*, John Wiley & Sons, 1984.
3. H. J. Arnika, *Essentials of Nuclear Chemistry*, 4th Edn., New Age International Publishers Ltd., New Delhi, 1995.
4. F. A. Cotton, Wilkinson, G. and P. L. Gaus, *Basic Inorganic Chemistry*, 3rdEdn., John Wiley & Sons, New York, 1995.
5. J. D. Lee, *Concise Inorganic Chemistry*, 5th Edn., Chapman and Hall, London, 1996.
6. J. E. Huheey, E. A. Keiter and R. L. Keiter, *Inorganic Chemistry - Principles of Structure and Reactivity*, 4thEdn., Harper Collins, New York, 1993.
7. D. M. P. Mingos and D. J. Wales, *Introduction to Cluster Chemistry*, Prentice Hall, 1990.
8. N. N. Greenwood and E. A. Earnshaw, *Chemistry of Elements*, Pergaman Press, 1984.
9. T. Chivers, I. Manners, *Inorganic Rings and Polymers of the p-Block Elements, from Fundamentals to Applications*, RSC Publishing, 2009.
10. F. Sécheresse, *Polyoxometalate Chemistry: Some Recent Trends*, World Scientific Series in Nanoscience and Nanotechnology: Volume 8, 2013.

COURSE OBJECTIVES

To introduce the students to the basics of solid state chemistry and structural paradigms in main group and early transition elements, and their rings, cages and cluster compounds. To give a brief idea on the nuclear chemistry.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
Course Outcomes	
Students will learn about	
1. Understand the fundamentals of solid-state chemistry.	
2. Isolobal analogy and structural paradigms in cluster chemistry	
3. Structure and reactivity of main group compounds	
4. Learn about the basics of nuclear chemistry and its applications.	

COURSE PLAN – PART II

COURSE OVERVIEW

This course is offered to II year M.Sc.(Chemistry) students. This is 3 credit theory course. Three theory classes will be conducted per week.

COURSE TEACHING AND LEARNING ACTIVITIES

Sl.No	Week	Topic	Mode of Delivery
1	I WEEK AUG/2021	Solid state - close packing of atoms and ions - bcc, fcc and hcp voids - structures of rock salt -	PPT
2	II WEEK AUG/2021	caesium chloride - wurtzite - zinc blende - rutile - fluorite - antiferite - diamond and graphite - spinel - normal and inverse spinel's and perovskite.	PPT
3	III WEEK AUG/2021	Band theory of solids, dislocation in solids: Schottky and Frenkel defects. Electrical properties: Energy bands, insulators, semiconductors and conductors- super conductors.	PPT
4	IV WEEK AUG/2021	Isolobal Analogy- Structure and bonding in polyhedral boranes and carboranes, styx notation; Wade's rule; electron count in polyhedral boranes; synthesis of polyhedral boranes-	PPT
5	I WEEK SEPT /2021	Wade-Mingos and Jemmis electron counting rules- Heteronuclear clusters-carboranes and heteroboranes -main group metal clusters: Isolobal analogs of p-block clusters	PPT
6	II WEEK SEPT/2021	Boron halides; phosphine-boranes; borazine- phosphorous halides, acids and oxyacids, phosphazenes- sulphur halides, oxo acids of sulphur- structural features and reactivity of reactivity of S-N heterocycles;	PPT
7	III WEEK SEPT/2021	chemistry of halogens and Noble gases. Synthesis and reactivity of organo-lithium, -beryllium and -magnesium compounds- Organyls	PPT

		of Al, Ga, In and Tl. Silanes, silicon halides, silicates, silanols; germanium, tin and lead organyls.		
8	IV WEEK SEPT/2021	Preparation, properties of isopolyoxo anions – heteropolyoxo anions. Cages and rings formed by the early transition metal elements and metal-chalcogeno anions.	PPT	
9	I WEEK OCT/2021	Coordination cages – the concept of encapsulation chemistry and confinement driven modified reactions.	PPT	
10	II WEEK OCT/2021	Preparation, properties of isopolyoxo anions – heteropolyoxo anions. Cages and rings formed by the early transition metal elements and metal-chalcogeno anions.	PPT	
11	III WEEK OCT/2021	Coordination cages – the concept of encapsulation chemistry and confinement driven modified reactions.	PPT	
12	IV WEEK OCT/2021	Mass and charge, nuclear moments, binding energy, mass defect, packing fraction, stability,	PPT	
13	I WEEK NOV/2021	magic numbers. Modes of radioactive decay and rate of radioactive decay-half-life, average life,	PPT	
14	II WEEK NOV/2021	Energetics and types- nuclear fission-liquid drop model- nuclear fusion-essential features of nuclear reactors-	PPT	
15	III WEEK NOV/2021	tracer techniques, neutron activation analysis- carbon and rock dating - application of tracers in chemical analysis, reaction mechanisms, medicine and industry.	PPT	
COURSE ASSESSMENT METHODS (shall range from 4 to 6)				
S.No	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment I (Assignment/Quiz)	II WEEK AUG/2021	30 minutes	5

2	Assessment II (CT – 1)	III WEEK SEPT/2021	1 hour	20
3	Assessment III (Assignment/Seminar)	II WEEK OCT/2021	30 minutes	5
4	Assessment IV (CT – 2)	II WEEK NOV/2021	1 hour	20
CPA	Compensation Assessment*	III WEEK NOV 2021	1 hour	20
5	Final Assessment *	I WEEK DEC 2021	3 hours	50

Theory = Total (100)

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Feedback from students during class committee meetings.
2. Anonymous feedback through questionnaire at the end of the semester

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email/phone)

sreekanth@nitt.edu/9489551851

COMPENSATION ASSESSMENT POLICY

For those students who missed Class Test I and/or Class Test II due to genuine reasons, compensation assessment will be conducted during III week of November 2021.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

The above policy against academic dishonesty shall be applicable for all the programmes.

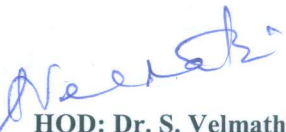
ADDITIONAL INFORMATION

The respective faculty will be available for consultation at times as per the intimation by the faculty.

FOR APPROVAL


Course Faculty: Dr. A. Sreekanth


CC-Chairperson: Dr. A. Sreekanth


HOD: Dr. S. Velmathi