

**GOVERNMENT POLYTECHNIC, JAJPUR**

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<b>Discipline:</b> Civil/ Mechanical/ Mining	<b>Semester:</b> 2nd	<b>Name of the Teaching faculty:</b> TUSHAR RANJAN MOHANTA, Sr. Lect. (Chemistry)
<b>Subject:</b> Applied Chemistry	<b>No of Days/Week</b> <b>Class allotted:</b> 4	<b>From Date:</b> 9.01.2026 to <b>Date:</b> 8.05.2026 <b>No. of weeks :</b> 15
<b>Week</b>	<b>Class Day</b>	<b>Topic</b>
1st	1st	Rutherford model of atom
	2nd	Bohr's theory (expression of energy and radius to be omitted)
	3rd	Hydrogen spectrum explanation based on Bohr's model of atom.
	4th	Heisenberg uncertainty principle.
2nd	1st	Quantum numbers orbital concept
	2nd	Shapes of S, P & D orbital
	3rd	Pauli's exclusion principle
	4th	Hund's rule of maximum multiplicity.
3rd	1st	Aufbau's principle
	2nd	Electronic Configuration
	3rd	Concept of Chemical Bonding
	4th	Cause of chemical bonding
4th	1st	Types of bonds: Ionic bonding (NaCl example)
	2nd	Covalent bond (H <sub>2</sub> , F <sub>2</sub> , HF Hybridization in BeCl <sub>2</sub> )
	3rd	Hybridization in BF <sub>3</sub> , CH <sub>4</sub> , NH <sub>3</sub> & H <sub>2</sub> O
	4th	Coordination bond in NH <sub>4</sub> <sup>+</sup> and anomalous properties of NH <sub>3</sub> & H <sub>2</sub> O due to hydrogen bonding
5th	1st	Metallic Bonding
	2nd	Idea of solute, solvent and solution, Methods to express the Concentration of solution Molarity (M= mole per liter) PPM Percentage Volume Percentage and mole fraction
	3rd	Problems
	4th	Graphical presentation of water distribution on earth (pie or bar diagram)
6th	1st	Classification of soft and hard water based on soap test, salt causing water hardness, unit of hardness & simple numerical on water hardness. Cause of poor lathering of soap in hard water
	2nd	Problems caused by the use of hard water in boiler scale & Sludge
	3rd	Foaming and priming, Corrosion
	4th	Quantitative measurement of water hardness by EDTA method.
7th	1st	Total dissolved solid (TDS) alkalinity estimation.
	2nd	Water Softening techniques - soda lime process
	3rd	Zeolite process and ion exchange process.
	4th	Sedimentation. Coagulation, Filtration, Sterilization Water of human consumption for drinking and cooking purposes from any water sources
8th	1st	enlist Indian standard specification of drinking water
	2nd	Natural occurrence of metals - Ores of iron, Aluminium, and Copper, Gangue (matrix)
	3rd	Flux, slag, metallurgy - brief account of general principles of metallurgy.
	4th	Extraction of iron from haematite are using blast furnace - Concentration, Calcination and smelting
9th	1st	Reactions in the blast furnace extraction of pure iron
	2nd	Al extraction - Hall's process, Bayer's process.
	3rd	Serppe's process, purification. Alloys-definition, purposes of alloying, ferrous alloys
	4th	non-ferrous with suitable examples, properties and application.
10th	1st	Part I and cement and hardening
	2nd	Glasses Refractory and composite materials.
	3rd	Polymers- monomer, homo and Co-polymer, degree of polymerization.
	4th	reaction involved in preparation of plastic (PVC, PS, PTFE)
11th	1st	Nylon-6, nylon-6,6 and bakelite).
	2nd	Rubber and vulcanization of rubber.



	3rd	Fuel and comof fule, Clasification of fuels, Calorific values (HCV and LCV).
	4th	calculation of HCV and LCV using Dulong's formula.
12th	1st	proximate analysis of coal solid fuel. Petrol and disel (Octane and Cetone numbers)
	2nd	Chemical composition, calorific values and applications of LPG, CNG, Water gas.
	3rd	Coal gas, Producer gas and biogas.
	4th	Lubrication - Function and charectoristic properties of good lubricant, Classification with example.
13th	1st	Lubrication mechanism - hydrodynamic and boundary lubrication.
	2nd	Viscopvity and viscosity index, oiliness, flash and fire point, could andpour point only.
	3rd	Chemical properties (coke number, total acid number, saponification value) of lubricants.
	4th	Electronic concept of Oxidation, reduction and redox reactions.
14th	1st	Electrolytes, non-electrolytes with suitable example, Faraday's 1st law.
	2nd	Faraday's 2nd law of electrolysis and numerical problems.
	3rd	Industrial application of electrolysis - Electrometallurgy, Electroplating, Electrolytic refining.
	4th	Primary cell- dry cell, Secondary cell- commercially used lead storage battery.
15th	1st	Fuel cell and solar cell
	2nd	Defination, types of corrosion (Chemical and Electrochemical), H2 liberation and O2 absorption
	3rd	Mechanism of electrochemical corrosion factors affecting rate of corrosion.
	4th	Purification, Alloying and heat treatment, External corrosion preventive measures: a) metal (anodic, cathodic) coatings, b) organic inhibitors.

#### References/Suggested Learning Resources:

##### (a) Books Recommended:

- ☐ Applied Chemistry by Dr. Anju Rawley (Download from <https://ekumbh.aicteindia.org/dbook.php>)
- ☐ Text Book of Chemistry for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
- ☐ Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press; New Delhi, 2015.
- ☐ C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
- ☐ Dara, S.S. & Dr.S.S.Umare, Engineering Chemistry, S.Chand. Publication, New Delhi, 2015.
- ☐ Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.
- ☐ Dr. Vairam. S., Engineering Chemistry, Wiley India Pvt.Ltd., New Delhi, 2013.
- ☐ Dr. G. H. Hugar & Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTR, Chandigarh, Publications, 2013-14.
- ☐ Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt.Ltd., 2014

##### (b) Open source software and website address:

- 1 . [www.chemguide.co.uk/atommenu.html](http://www.chemguide.co.uk/atommenu.html) (Atomic structure and chemical bonding)
- 2 . [www.visionlearning.com](http://www.visionlearning.com) (Atomic structure and chemical bonding)
- 3 . [www.chem1.com](http://www.chem1.com) (Atomic structure and chemical bonding)
- 4 . <https://www.wastewaterlearning.com/elearning/> ( Water Treatment)
- 5 . [www.capital-refractories.com](http://www.capital-refractories.com) (Metals, Alloys, Cement, and Refractory Materials)
- 6 . [www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf](http://www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf) (Fuel and Combustion)
- 7 . [www.chemcollective.org](http://www.chemcollective.org) (Metals, Alloys)
- 8 . [www.wqa.org](http://www.wqa.org) (Water Treatment)

Signature of the faculty

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(T.R. Mohanty)  
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*8/1/26*