



J.S.S. ACADEMY OF TECHNICAL EDUCATION, BENGALURU.
DEPARTMENT OF CHEMISTRY

LESSON PLAN
Academic Term: 2016-17

Course Name: Engineering chemistry theory	Course Code: 15CHE12/22	Branch/Sem: I/II
Name of the Faculty :	Contact Hrs : 4 hrs/week	Total Teaching Hrs : 50 hrs
SEE Marks : 80	IA Marks : 20	Exam Duration : 3 hrs

Pre-requisites:

- PR1. Faraday's Laws of electrolysis, Chemical equilibrium, Free energy, Galvanic cells, electrolytic cells
- PR2. Basic organic chemistry, reaction mechanism
- PR3. Drinking water standards, Municipal drinking water treatment, dialysis
- PR4. Chemistry of Colloids and precipitation

Course Outcomes: Student will be able to

1. Illustrate principles of electrochemistry and their applications to batteries and fuel cells.
2. Interpret the reason for corrosion and practices for the prevention.
3. Demonstrate the quality and efficiency of conventional fuels and solar energy.
4. Predict and select appropriate polymer for engineering applications.
5. Solve water related problems encountered in industrial and domestic applications.
6. Outline the synthesis and applications of nanomaterials

Module No.	Class No.	Date	Time	Topic covered	Teaching Aid	Reference Material	Remarks
Module -1 Electrochemistry and Battery Technology	1			Electrochemistry: Introduction, Derivation of Nernst equation for electrode potential.	Black Board	Text Book	CO1
	2			Reference electrodes: calomel electrode.	Calomel electrode	Text Book http://community.asdlib.org/activelearningmaterials/files/2014/01/Potentiometry_Reference_Electrodes.pdf	CO1
	3			Ag / AgCl electrode. Measurement of standard electrode potential using calomel electrode	Black board	Text book	CO1
	4			Ion selective electrode: Introduction; Construction and working of glass electrode, determination of pH using glass electrode.	Glass electrode	Text book http://www.electrochem.org/dl/interface/sum/sum04/IF6-04-Pages19-20.pdf	CO1
	5			Concentration cells: Electrolyte concentration cell, numerical problems on concentration cells	Black board	Text book	CO1
	6			Battery Technology: Introduction, classification of batteries.	Black board	Text book https://www.google.co.in/electrochemistry	CO1
	7			Battery Characteristics- cell potential, current, capacity, electricity storage density, energy efficiency, cycle life and shelf life.	Black board	Text book http://www.mpoweruk.com/performance.htm	CO1
	8			Construction, working and applications of Zinc-Air cell and Nickel- Metal hydride battery. Lithium batteries: Li-MnO ₂	Black board	Text book http://www.fda.gov/downloads/RegulatoryInformation/Guidances/UCM127834.pdf	CO1
	9			Li-ion batteries. Fuel Cells: Introduction, differences between conventional cell and fuel cell.	Black board	Lithium Ion rechargeable Batteries: Materials, Technology, and New Applications edited by Kazunori Ozawa	CO1
	10			Limitations & advantages of fuel cells. Construction & working of methanol-oxygen fuel cell	Black board	Text book http://www.wiley-vch.de/books/sample/3527323775_c01.pdf	CO1

Module No.	Class No.	Date	Time	Topic covered	Teaching Aid	Reference Material	Remarks
<i>Module-2</i> <i>Corrosion and Metal finishing</i>	11			Corrosion: Introduction, electrochemical theory of corrosion	Black board	Text book	CO2
	12			Types of corrosion -Differential metal, differential aeration and stress corrosion.	Boiler material	Text book	CO2
	13			Factors affecting the rate of corrosion - ratio of anodic to cathodic areas, nature of metal, nature of corrosion product, nature of medium – pH, conductivity, and temperature.	Black board	Text book	CO2
	14			Corrosion control: Inorganic coatings-Anodizing of Al and phosphating.	Black board	Text book http://nzic.org.nz/ChemProcesses/metals/8E.pdf	CO2
	15			Metal coatings-Galvanizing and Tinning. Cathodic protection (sacrificial anodic and impressed current methods).	Black board	Text book	CO2
	16			Metal Finishing: Introduction, Technological importance. Electroplating: Principles governing-Polarization, decomposition potential & overvoltage.	Black board	Text book	CO2
	17			Factors influencing the nature of electro deposit - current density, concentration of metal ion & electrolyte; pH, temperature.	Black board	Text book	CO2
	18			Throwing power of plating bath; additives-brighteners, levellers, structure modifiers & wetting agents. Electroplating of chromium (decorative & hard) and Nickel (Watt's bath).	Black board	Text book http://www.casf.ca/wp-content/uploads/2014/04/NickelElectroplating.pdf	CO2
	19			Electroless plating: Introduction, distinction between electroplating and Electroless plating.	Black board	Text book	CO2
	20			Electroless plating of copper & manufacture of double sided Printed Circuit Board with copper.	Black board	Text book http://www.electrochemsci.org/papers/vol9/91207795.pdf	CO2

Module No.	Class No.	Date	Time	Topic covered	Teaching Aid	Reference Material	Remarks
<i>Module-3 Fuels & Solar energy</i>	21			Fuels: Introduction, classification, calorific value-gross and net calorific values.	Black board	Text book	CO3
	22			Determination of calorific value of a fuel using bomb calorimeter, numerical problems.	Black board	Text book	CO3
	23			Cracking: Introduction fluidized catalytic cracking, synthesis of petrol by Fischer-Tropsch process.	Black board	Text book	CO3
	24			Reformation of petrol, octane and Cetane numbers.	Black Board	Text book	CO3
	25			Gasoline and diesel knocking and their mechanism.	Black Board	Text book	CO3
	26			Anti-knocking agents, power alcohol & biodiesel.	Black Board	Text book	CO3
	27			Solar Energy: Introduction, utilization and conversion, photovoltaic cells - importance, construction and working.	Black Board	Text book	CO3
	28			Design: modules, panels & arrays. Advantages & disadvantages of PV cells.	Black Board	Text book	CO3
	29			Production of solar grade silicon (union carbide process)	Black Board	Text book http://www.diva-portal.org/smash/get/diva2:123654/FULLTEXT01.pdf	CO3
	30			Quiz-1 (CO1, CO2 & CO3)		Question bank	CO1, CO2 & CO3
31			Purification of silicon (zone refining) and Doping of silicon-diffusion technique (n & p types).	Black Board	Text book	CO3	

Module No.	Class No.	Date	Time	Topic covered	Teaching Aid	Reference Material	Remarks
<i>Module - 4 Polymers</i>	32			Polymers: Introduction, types of polymerization: addition and condensation. Polymer as engineering material	Black Board	Text book http://www.materials.manchester.ac.uk/study/postgraduate-taught/polymer-materials-science-and-engineering-msc/	CO4
	33			Mechanism of polymerization: Free radical mechanism taking vinyl chloride as an example.	Black Board	Text book	CO4
	34			Molecular weight of polymers: number average and weight average, numerical problems.	Black Board	Text book	CO4
	35			Glass transition temperature (T _g): Factors influencing T _g - flexibility, inter molecular forces, molecular mass, branching and cross linking and stereo-regularity. Significance of T _g	Black Board	Text book	CO4
	36			Structure property relationship – Crystallinity, tensile strength, elasticity, and chemical resistivity.	Black Board	Text book	CO4
	37			Synthesis, properties and applications of PMMA (plexi glass), Polyurethane and polycarbonate	Black Board	Text book	CO4
	38			Elastomers: Introduction, synthesis, properties and applications of Silicone rubber	Black Board	Text book	CO4
	39			Adhesives: Introduction, synthesis, properties and applications of epoxy resin.	Black Board	Text book	CO4
	40			Polymer Composites: Introduction, synthesis, properties and applications of Kevlar.	Black Board	Text book	CO4
41			Conducting polymers: Introduction, mechanism of conduction in Polyaniline and applications of conducting polyaniline.	Black Board	Text book http://www.ki.ku.dk/dokumenter/andet/polyanilin.pdf/	CO4	

Module No.	Class No.	Date	Time	Topic covered	Teaching Aid	Reference Material	Remarks
<i>Module-5</i> <i>Water technology and nanomaterials</i>	42			Water Technology: Introduction, Boiler feed water, boiler troubles with disadvantages - scale and sludge formation.	Black Board	Text book	CO5
	43			Visit to AJDTC	Live demo	Prof. Manjunath D. P., The Chief Executive, AJDTC, JSS Campus, JSSATEB	CO3
	44			Priming and foaming.	Black Board	Text book	CO5
	45			Boiler corrosion (due to dissolved O ₂ , CO ₂ and MgCl ₂)	Black Board	Text book	CO5
	46			Determination of DO, BOD	Black Board	Text book	CO5
	47			Determination of COD, numerical problems	Black Board	Text book	CO5
	48			Sewage treatment: Primary, secondary and tertiary methods. Softening of water by ion exchange process.	De-ionizer in the lab	Text book	CO5
	49			Desalination of sea water by reverse osmosis & electrodialysis.	Black Board	Text book www.oas.org/dsd/publications/Unit/oea59e/ch20.htm	CO5
	50			Nanomaterials: Introduction, properties (size dependent), synthesis-bottom up approach-sol-gel, precipitation.	Black Board	Text book The Chemistry of Nanomaterials: Synthesis, Properties and Applications edited by C. N. R. Rao, Achim Müller, Anthony K. Cheetham	CO5
	51			Gas condensation, chemical vapor condensation.	Black Board	Text book	CO5
52			Nano scale materials- fullerenes, carbon nano tubes, nano wires, nano rods, dendrimers & nano composites	Black Board	Text book	CO5	

Remedial classes for slow learners, after IA-1, and IA-2

Total No. of Hours required as per VTU: 50	Total No. of classes planned: 52
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Text Books:

- “Engineering Chemistry” by Mahesh B and Roopashree B, Sun star publications, Bangalore.
- A text book of Engineering Chemistry – by Jain and Jain, Danpatrai publications, New Delhi.
- “Chemistry for Engineering Students” by B.S. Jai Prakash, R.Venugopal, Sivakumaraiah & Pushpa Iyengar. Subhash Publications, Bangalore.
- “Engineering Chemistry” by R.V.Gadag & A.Nityananda Shetty, I K International Publishing House Private Ltd. New Delhi.

Reference books:

- **Chemical & Electrochemical energy systems** by R Narayan & B Viswanathan.
- **Corrosion Engg.** By M.G.Fontana.
- **“Nanochemistry: A Chemical Approach to Nanomaterials”** by G.A.Ozin & A.C. Arsenault, RSC publishing, 2005.
- **“Wiley Engineering Chemistry”**, Wiley India Pvt. Ltd. New Delhi, Second Edition.
- **“Polymer Science”** by V.R.Gowariker, N.V. Viswanathan & J. Sreedhar, Wiley-Eastern Ltd.

Internal assessment syllabus

IA test	Syllabus	Approx. Syllabus Covered, %	Date	COs
1	Modules 1, 2 and 3(Fuels)	60		CO1, CO2 & CO3
2	Modules 3 (Solar energy), 4 & 5	94		CO3, CO4 & CO5
3	Modules 1,2,3,4 & 5	100		CO1, CO2, CO3, CO4 & CO5

The average of highest marks scored in any two tests is considered for awarding the final IA marks.

Scheme of VTU examination:

Two questions are set from each module (Total eight questions). Students have to answer Four full questions choosing one question from each module.