SRI VENKATESWARA COLLEGE OF ENGINEERING

COURSE DELIVERY PLAN - THEORY

Department of Applied Chemistry		LP: CY22152
B.E/B.Tech	: Common to **AUT and MEC** branches Regulation: 2022	Rev. No: 00
Sub. Code / Sub. Name	: **CY22152 / ENGINEERING CHEMISTRY**	Date: 08.11.2022
Unit	: 1	

UNIT 1 ELECTROCHEMISTRY 09

Electrodes and electrochemical cells – electrode potential, standard electrode potential, single electrode potential and its determination, types of electrodes – calomel, quinhydrone and glass electrode. Nernst equation - determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Batteries – Primary (dry battery) and secondary batteries (Lead – acid storage battery and Lithium ion battery) and next generation batteries.

Objective: To make the students to understand the importance of electrochemistry.

Session No *	Topics to be covered	Books	Teaching Aids
1	Electrodes and electrochemical cells. Cell terminology, Types of cell- Electrochemical cell and electrolytic cell.	R2/CH24/PG :835	LCD / BB
2	Electrode potential- Origin, oxidation and reduction potential, Standard Hydrogen Electrode potential (SHE) - Construction & working principle and its use in determination of unknown electrode potential.	R2/CH24/PG : 838	LCD / BB
3	Construction & working principle of calomel, quinhydrone and glass electrodes.	R2/CH24/PG : 837	LCD / BB
4	Derivation of Nernst equation – Concentration dependence of electrode potential. Applications of Nernst equation.	R2/CH24/PG : 844	LCD / BB
5	Determination of pH of a solution by using quinhydrone and glass electrodes.	R2/CH24/PG : 845	LCD / BB
6	Electrochemical series – Arrangement of reduction potentials.EMF series- Applications	R2/CH24/PG : 846,865	LCD / BB
7	Batteries –Definition, Primary batteries- Construction & working principle of dry cells, Zinc-Carbon batteries and alkaline batteries.	T2/CH4/PG :129	LCD / BB
8	Secondary batteries - (Rechargeable)- Construction, working principle and uses of Lead – Acid storage battery and Lithium battery.	T2/CH4/PG :132	LCD / BB
9	Next generation batteries- Higher energy density – Construction, working principle and advantages of Aluminium- Air battery and Lithium ion solid battery.	T2/CH4/PG :131, 134	LCD / BB

Content beyond syllabus covered (if any): Fuel cells

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Sub. Code / Sub. Name: **CY22152 / ENGINEERING CHEMISTRY**

Unit : 2

UNIT 2 **PHOTOCHEMISTRY** **09**

Laws of photochemistry – Grotthuss-Draper law, Stark–Einstein law and Lambert Beer Law – determination iron by spectrophotometer. Quantum efficiency – Photo physical processes - internal conversion, inter-system crossing, fluorescence, phosphorescence and photo-sensitization-Quenching of fluorescence and its kinetics, Stern-Volmer relationship. Applications of photochemistry.

Objective: To enable the students to acquire knowledge on photochemical process and laws of photochemistry and its applications

Objective: To understand the applications of engineering materials.

Session No *	Topics to be covered	Ref	Teaching Aids
10	Introduction to electromagnetic radiation and its properties	T1/CH35/PG:1193-1195	LCD / BB
11	Photochemistry– Photochemical reactions with examples – difference between photochemical and thermal reaction	T1/CH34/PG : 1141-1143	LCD / BB
12	Laws of Photochemistry - Grotthus – Draper law, Stark–Einstein law and Beer-Lambert Law – Applications and Limitations	T1/CH34/PG : 1143-1145	LCD / BB
13	Beer-Lambert Law – problems; determination of iron by spectrophotometer	T1/CH34/PG : 1182-1187	LCD / BB
14	Quantum efficiency (Φ) - classification of reactions based on quantum yield – Reason for high and low quantum yield, High quantum yield - Example: Formation of HCl; Low quantum yield - Example: Formation of HBr	T1/CH34/PG : 1147-1150	LCD / BB
15	Jablonski Diagram - Internal conversion - Inter-system crossing Fluorescence & Phosphorescence	T1/CH34/PG : 1154-1157	LCD / BB
16	Photosensitization – Mechanism and examples - quenching Difference between Fluorescence and Phosphorescence	T1/CH34/PG : 1158-1162	LCD / BB
17	Photochemical reaction kinetics with example	T1/CH34/PG : 1151-1153	LCD / BB
18	Stern-Volmer relationship and Applications of photochemistry	R1/CH29/PG:1133-1134	LCD / BB
Content beyond syllabus covered (if any): Photocatalyst and applications			

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Sub. Code / Sub. Name: **CY22152 / ENGINEERING CHEMISTRY**

Unit : 3

UNIT 3 **NANOCHEMISTRY** **09**

Basics and scale of nanotechnology, different classes of nanomaterials, Distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Synthesis of nanomaterials, fabrication (lithography) and its applications – Basics of nanophotonics and quantum confined materials (surface plasmon resonance).

Objective: To acquaint the students with the basics of nanomaterials, their properties and uses.

Session No *	Topics to be covered	Ref	Teaching Aids
19	Introduction - Basics of Nanochemistry – Nano-technology – Nano-science – Nano-Chemistry features.	T1/CH 37/PG: 1303, 1304	LCD/BB
20	Difference between Nanomaterials and Bulk Materials.	T1/CH 37/PG: 1303, 1304	LCD/BB
21	Properties of nanomaterials-Physical and chemical.	T1/CH 37/PG: 1304,1337-1338	LCD/BB
22	Synthesis of nanomaterials - Mechanical milling, vibratory milling, or attrition milling, Mechanochemical synthesis,	T1/CH 37/PG: 1332-1337, R1/22/971-972	LCD/BB
23	Laser ablation & Ion sputtering-Fabrication and its application	T1/CH 37/PG: 1332-1337, R1/22/972-979	LCD/BB
24	Synthesis of nanomaterials-Bottom-up approach- Physical vapor deposition method (PVD), Chemical vapor deposition method (CVD).	T1/CH 37/PG:1317-1332, R1/22/961-971	LCD/BB
25	Synthesis of nanomaterials - Top down approach-Sol gel method, Hydrothermal method, Chemical reduction method, Solvothermal method	T1/CH 37/PG:1317-1332	LCD/BB
26	Nanophotonics-Fundamentals, Challenges, Future Prospects and Applied Applications.	T1/CH 37/PG:1337	LCD/BB
27	Quantum confined materials-Size effect, (surface plasmon resonance (SPR)-principle, application).	T1/CH 37/PG:1304-1305	LCD/BB
Content beyond syllabus covered (if any): Carbon nanotubes			

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COURSE DELIVERY PLAN - THEORY

Sub. Code / Sub. Name: **CY22152 / ENGINEERING CHEMISTRY**

Unit : 4

UNIT 4 ENGINEERING MATERIALS

09

Abrasives: definition, classification, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Lubricants – classification, properties and applications. Basics of composite materials, properties and applications.

Objective: To understand the applications of engineering materials.

Session No *	Topics to be covered	Ref	Teaching Aids
28	Abrasives: definition, Moh's scale and classification.	T1/CH11/PG : 453	LCD / BB
29	Application of abrasives-Grinding wheel, abrasive paper and cloth.	T1/CH11/PG : 454	LCD / BB
30	Refractories: definition, characteristics and classification, properties – Chemical inertness and Refractoriness.	T1/CH11/PG : 454-455	LCD / BB
31	Properties – refractoriness (Pyrometric Cone Analysis) and RUL, dimensional stability, thermal spalling, thermal expansion and porosity.	T1/CH11/PG : 457-458	LCD / BB
32	Manufacture of Alumina, Magnesite and Silicon carbide.	T1/CH11/PG :459-462	LCD / BB
33	Lubricants – classification – liquid, semi-solid and solid, properties of lubricants- mechanism of lubrication.	T1/CH10/PG : 427,435	LCD / BB
34	Lubricants – Applications in heavy industry, corrosion inhibition, soaps and paint making etc.,	T1/CH10/PG :445	LCD / BB
35	Composite materials- Classification based on matrix and reinforcements, FRP, properties.	T1/CH29/PG : 1005-1011	LCD / BB
36	Composite materials and its applications eg., Aerospace, medicine, sports civil infrastructure, marine.	T1/CH2/PG :1013	LCD / BB

Content beyond syllabus covered (if any): Quick setting cement

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Sub. Code / Sub. Name: **CY22152 / ENGINEERING CHEMISTRY**

Unit : 5

Unit Syllabus: FUELS AND COMBUSTION

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- refining - manufacture of synthetic petrol (Bergius process)- knocking- octane number - diesel oil- cetane number - natural gas- compressed natural gas(CNG)- liquefied petroleum gases(LPG)- producer gas- water gas. Combustion of fuels: Introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio - flue gas analysis (ORSAT Method)- uses of catalytic converters.

Objective: To familiarize the manufacture of fuels.

Session No *	Topics to be covered	Ref	Teaching Aids
37	Fuels – definition, classification (solid, liquid & gas) calorific value, Gross and Net calorific value -Dulong's formula.	T1/CH2/PG : 55-56, 62, 99, 100	LCD / BB
38	Solid fuel - varieties of coal. Proximate analysis of coal and its significance. problems	T1/CH2/PG : 63-67	LCD / BB
39	Ultimate analysis of coal and its significance - Carbonization process - Otto Hoffmann process recovery of by products	T1/CH2/PG : 67-72	LCD / BB
40	Liquid fuel – Petroleum – Classification, Refining of crude oil – Fractions and uses.	T1/CH2/PG : 72-75	LCD / BB
41	Synthetic petrol – Manufacture by Bergius process. Knocking – Octane and Cetane number – Improvement	T1/CH2/PG : 78, 79 & 81-83	LCD / BB
42	Gaseous fuels – CNG, LPG, Water gas and Producer gas – Composition, manufacture and uses.	T1/CH2/PG : 83-90	LCD / BB
43	Combustion- Theoretical calculation of air by weight - problems	T1/CH2/PG : 95-97, 102-108	LCD / BB
44	Theoretical calculation of air by volume - problems	T1/CH2/PG : 95-97, 102-108	LCD / BB
45	Flue gas analysis by Orsat method and its significance. Catalytic converters and its uses. Summarization of topics discussed in unit V	T1/CH2/PG : 97, 98	LCD / BB
Content beyond syllabus covered (if any): Biofuels			

*** Session duration: 50 mins**

OUTCOMES:

Upon successful completion of the course, students should be able to:

1. Describe the electrolytic and electrochemical cell, various fundamental aspects of electrochemistry
2. Interpret the photochemical reactions and their applications
3. Differentiate the nano and bulk materials, their synthesis and its applications in various fields.
4. Acquire the basic properties of engineering materials and its applications
5. To calculate the calorific value of fuels and also to analyze the quality of fuels and combustion process

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpet Rai & Sons, New Delhi, 17th Edition, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.

REFERENCES:

1. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
2. B.R. Puri, L.R. Sharma, M.S. Pathania., "Principles of Physical Chemistry", 47th edition, Vishal Publishing C., Jalandhar 2018.
3. Text Book of Organic Chemistry, P.L.Sony and H.M.Chawla, Sultan Chand and Sons Publishers, New Delhi, 2000.

	Prepared by	Approved by
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Name	Dr G Baskar Dr M Thirumalaikumar	Dr. G. Devasagayam
Designation	Asst. Professor	Prof. & Head
Date	08.11.2022	08.11.2022
Remarks *:		

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD