U17CHT1009 **Polymer Chemistry**
(Common to Textile, and FT)

L	T	P	J	C
3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Discuss the types of polymer formation (K2)
CO2: Discuss the mechanism of polymer formation (K2)
CO3: Explain the various polymerization techniques (K2)
CO4: Discuss the polymer processing (K2)
CO5: Discuss the fiber processing (K3)
CO6: Outline the principles and instrumentation of spectroscopic techniques involved in material characterization (K2)

Pre-requisites :

NIL

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M					M						
CO2	S											
CO3	M	M				M						
CO4	M		M			M						
CO5	S											
CO6	M											

Course Assessment methods

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation,Prototype or Product Demonstrationetc (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

POLYMERS **9 Hours**

Introduction - Degree of polymerisation - Functionality -Tacticity- Classification based on source, application, thermal properties (thermosetting and thermoplastics) - Glass transition temperature - Effect of polymer structure on properties -Types of polymerisation (Addition, condensation, Co-polymerization, Ring polymerisation) - Mechanism of polymerisation (free radical mechanism, Anionic, Cationic and Coordination mechanism).

POLYMERISATION TECHNIQUES **9 Hours**

Homogeneous and Heterogeneous polymerization - Bulk (PVC) - Solution (PAN) - Suspension (PVA) - Emulsion polymerisation (PMMA) - Melt poly condensation (PET) - Solution poly condensation (Polyester resins) - Interfacial poly condensation (Polyamides).

9 Hours

POLYMER PROCESSING

Film casting - Calendering - Thermoforming - Foaming - Moulding Techniques: Compression, Injection, Extrusion and Blow mouldings.
Fibre spinning: Melt, Dry and Wet spinning

FIBRE FORMING POLYMERS 9 Hours

Characteristics of fibre forming polymers - Preparation, Properties,Fibre forming process and Application of Polyethylene, Polyacrylicacid, Nylon 6,6; PET, Nylon 6

SPECTROSCOPIC TECHNIQUES 9 Hours

Introduction to Spectroscopy- Beer Lambert's Law
Principle, Instrumentation (Block diagram only) and Application of Colorimetric analysis (Estimation of concentration of Ferrous and Copper ions in solution), IR Spectroscopy, Flame Photometry, SEM

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Gowariker V.R, Viswanathan N.V. and Sreedhar J, Polymer Science, New Age International P (Ltd.,), Chennai, 2016.
2. Seymour R.B. and Carraher C.E. Jr, Polymer chemistry, 6th Edition, Plenum Pub. Corporation, New York, 2003.
3. Alfredo Campo E, Industrial Polymers, Hanser Publishers, USA, 2008.
4. Syed Shabudeen, P.S. and Shoba U.S., Engineering Chemistry, Inder Publishers, Coimbatore. 2014
5. Gupta V.B. and Kothari V.K., Manufactured Fibre Technology, Springer Netherlands, First edition 1997.

U17CHT2006 **Chemistry for Textiles (Common for FT and Textile)**

L	T	P	J	C
3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Design a water purifier (K4)
CO2: Discuss the adsorption and its application (K2)
CO3: Describe interaction in fibers (K2)
CO4: Analyse the chemical group present and classify the dyes (K3)
CO5: Analyse the usage of specialty chemicals in various applications (K2)
CO6: Discuss different additives used for polymers in textiles (K2)

Pre-requisites :

NIL

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M					M						
CO2	M											
CO3	W	M				M						
CO4	S		M			M						
CO5	S											
CO6	M											

Course Assessment methods

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation,Prototype or Product Demonstrationetc (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

WATER TECHNOLOGY 9 Hours

Disadvantages of Hard water: In textile industries - as boiler feed water - formation of deposits in steam boilers and heat exchangers, wastage of fuel, decrease in efficiency of boilers, priming, foaming, caustic embrittlement, boiler corrosion.

Prevention of scale formation: External treatment (Ion exchange method) - Internal treatment (colloidal, phosphate, calgon and carbonate conditioning) - Desalination (Reverse osmosis and electrophoresis) - Domestic water treatment and effluent treatment.

SURFACE CHEMISTRY 9 Hours

Introduction of adsorption - Types of Adsorption - Adsorption isotherm (Freundlich isotherm, Langmuir adsorption isotherm) - Applications of adsorption: Role of adsorption in catalytic reactions, Ion exchange adsorption, adsorption chromatography (Column chromatography).

CHEMICAL BONDING 9 Hours

Ionic, covalent and co-ordinate covalent bonds (overview only) - hydrogen bonding and its consequences - VanderWaal's forces (dipole - dipole, dipole - induced dipole, induced dipole

- induced dipole interactions) -Interaction of enzymes with fibres(basic concepts only) - Interaction between fibers and dyes (basic concepts only) - Dyes substrate affinity (dyes for cellulose fibres, silk)

DYES **9 Hours**

Introduction - Classification system of dyes - Chromophore and auxochromes - Important chemical chromophores of dyes classes (azo, anthraquinone, phthalocyanin, Indigoid, polymethine, phthalocyanine, metal complex, Fluorescien) - synthesis of azo dye (Congo red), triaryl methane dye (Malachite green), Anthraquinone dye (Alizarin - 1,2 dihydroxyanthraquinone), Indigoid dye (Indigo), phthalein dyes (Eosin)

ANTHOLOGY OF SPECIALITY CHEMICALS IN TEXTILES AND ADDITIVES FOR POLYMERS IN TEXTILES **9 Hours**

An introduction on chemistry of the following in textiles: Dispersing agents, Leveling agents, Retarding agents, Dye fixing agents.

Additives for polymers:

Moulding constituents - fillers, plasticizers, lubricants, anti-aging additives, antioxidants, antiozonants, UV stabilizers, blow agents, crosslinking agents.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Amarika Singh, *Vairam S.and* Suba Ramesh., Chemistry for Engineers., Wiley India Ltd., New Delhi, 2010
2. Syed Shabudeen, P.S. and Shoba U.S., Chemistry for Textiles, Inder Publishers, Coimbatore, 2014
3. Finar I.L, Organic chemistry, Pearson Publishers, UK, 2012
4. Hungar K., Industrial Dyes - Chemistry, properties and applications, Wiley VCH Verlag GmbH & Co., KGaA, Weinheim., 2004
5. Gowariker V.R, Viswanathan N.V. and Sreedhar J, Polymer Science, New Age International P (Ltd.,), Chennai, 2016.
6. Seymour R.B. and Carraher C.E. Jr, Polymer chemistry, 6th Edition, Plenum Pub. Corporation, New York, 2003.
7. Sivaramakrishnan C.N., Anthology of speciality chemicals for textiles, Colour Pub. (P) Ltd., Mumbai, India, 2007
8. Bahl B.S. and Arun Bahl., Advanced *Organic Chemistry*, S. Chand & Co., New Delhi, 2014

U17CHT1004

Chemistry for Circuit Engineering
(Common to Electronics and Communication Engineering and Electronics and Instrumentation Engineering)

L	T	P	J	C
3	0	0	0	3

Course Outcomes
After successful completion of this course, the students should be able to
CO1: Discuss Basic concepts of electrochemistry involved in corrosion (K3)
CO2: Apply the principle of electrochemistry and assemble a battery (K4)
CO3: Outline the principles of electrode assembly in biomedical instrumentation. (K2)
CO4: Discuss the thermodynamic concepts and predict the feasibility of chemical reaction. (K2)
CO5: Outline about PCB and discuss the process of PCB fabrication(K2)
CO6: Apply the concepts of etching and plating in developing printed circuit boards (K3)

Pre-requisites :
NIL

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					M						
CO2	M											
CO3	W	M				M						
CO4	S		M			M						
CO5	S											
CO6	M											

Course Assessment methods

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

ELECTROCHEMISTRY 9 Hours
Introduction - Electrode potential - Nernst equation and problems - Electrochemical series - Application of EMF measurements and problems - Kohlrausch law of independent migration of ions and its application
Electrodes: Standard and Reference electrode (Hydrogen and Calomel) - Types of electrodes (Metal - Metal ion; Metal - Metal insoluble salt, Redox electrode) - Ion selective (glass electrode) - Classification of electrochemical cell.

BIOELECTRODES 12 Hours
Introduction -Tissue interface - Determination of pH, pO_2, pCO_2 using electrodes - Electrodes for ECG - Electrodes for EEG - Dry electrodes: Dry contact and non-contact electrodes (overview)
Electrical conductivity of Electrode Jellies and Creams: Introduction -Microelectrodes: Glass micro capillary electrodes and Metal micro electrodes.

ENERGY STORING DEVICES 12 Hours

Batteries: Factors for selection of batteries - Rating calculation using datasheet.
Primary Battery (Alkaline battery) - Secondary Battery (Lead acid storage battery, Nickel - Cadmium battery, Lithium ion battery and Lithium polymer battery) - Nuclear battery-Nano battery
Flow battery: Introduction - Construction of types of fuel cell
Solar Cells: Silicon Solar cells - Hybrid Solar cells - Dye sensitized Solar cells - Tandem Solar cells.

THERMODYNAMICS 3 Hours

Introduction - Thermodynamic process (isothermic, isobaric, isochoric and adiabatic processes) - Internal energy -First law of thermodynamics (Mathematical derivation and limitation) - Second law of thermodynamics - Third law and Zeroeth law of thermodynamics -Work function -Ficks law of diffusion.

BASICS OF PRINTED CIRCUIT BOARDS 9 Hours

Introduction - Components and Types of PCB –Advantages and Disadvantages - Flexible printed circuit boards (an overview)
Chemistry of Laminates in PCB: Properties and Types
Fabrication Process involved in PCB : Subtractive process – Additive process
Etching Techniques: Etching solutions - Electrochemical etching of Cu from PCB
Plating Techniques: Plating -Need for plating - Electroforming -Electropolishing - Electrochemical machining- Electrophoretic painting

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Glasstone S., An introduction to Electrochemistry, 10th Edition, Affiliated to East West Press Private Limited, 2007.
2. Derek Pletcher and Frank C Walsh., Industrial Electrochemistry, Blackie Academic and Professional, London, 1993.
3. David Linden & Thomas B. Reddy., Handbook of Batteries, 3rd edition, McGraw-Hill Companies, Inc. 2001
4. Revankar S.T., Majumdar P., Fuel Cell: Principles, Design and Analysis, CRC Press, 2014.
5. Syed Shabudeen, P.S. and Shoba U.S., Engineering Chemistry, Inder Publishers, Coimbatore. 2014
6. Jain P.C. and Jain. M., Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2017.
7. Seymour R.B. and Carraher C.E. Jr, Polymer chemistry, 6th Edition, Plenum Pub. Corporation, New York, 2003.
8. KhandpurR.S., Printed Circuit Boards Design, Fabrication and Assembly, McGraw-Hill Publishing Company Limited., New Delhi, 2005
9. KhandpurR.S.., Handbook of Biomedical Instrumentation, Tata McGraw-Hill Publishing Company Limited. New Delhi, 2014.

U17CHT2010 **CHEMISTRY FOR AERONAUTICAL ENGINEERING**

L	T	P	J	C
3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Discuss Basic concepts of electrochemistry involved in corrosion.
CO2: Defend the Corrosion problems.
CO3: Apply the principle of electrochemistry and assemble a battery.
CO4: Classify different types of propellants.
CO5: Discuss basic concepts of combustion.
CO6: Outline the principles and instrumentation of spectroscopic techniques involved in material characterization.

Pre-requisites: NIL

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M					M						
CO2	M											
CO3	W	M				M						
CO4	S		M			M						
CO5	S											
CO6	M											

Course Assessment methods

Direct

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable)
3. End Semester Examination

Indirect

1. Course-end survey

ELECTROCHEMISTRY 9 Hours

Introduction - Electrode potential - Nernst equation and problems - Electrochemical series - Application of EMF measurements and problems - Kohlrausch law of independent migration of ions and its application.

Electrodes: Standard and Reference electrode (Hydrogen and Calomel) - Types of electrodes (Metal - Metal ion; Metal - Metal insoluble salt, Redox electrode) - Ion selective (glass electrode) - Determination of pH, pO_2, pCO_2 - Classification of electrochemical cell.

CORROSION SCIENCE 6 Hours

Corrosion: Principles and Mechanism of electrochemical corrosion - Factors influencing corrosion.

Types of corrosion: Galvanic corrosion - Differential aeration corrosion (pitting corrosion, water line corrosion) - Stress corrosion.

Corrosion control: Inhibitors - Dehumidifier gels - Cathodic protection (sacrificial anode) - Plating Techniques: Plating - Need for plating - Electroforming - Electropolishing - Electrochemical machining - Electrophoretic painting.

ENERGY STORING DEVICES 12 Hours

Batteries: Factors for selection of batteries - Rating calculation using datasheet.

Primary Battery (Alkaline battery) - Secondary Battery (Lead acid storage battery, Nickel - Cadmium battery, Lithium ion battery and Lithium polymer battery) - Nuclear battery - Nano Battery

Flow battery: Introduction - Construction of types of fuel cell

Solar Cells: Silicon Solar cells - Hybrid Solar cells - Dye sensitized Solar cells - Tandem Solar cells.

PROPELLANTS AND COMBUSTION 9 Hours

Introduction - Classification of propellants : Solid, Composite, liquid, hybrid, Gelled

Performance of propellants : Gun – Force constant burning rate coefficients, vivacity, muzzle velocity, Rocket propellants – burn rate, thrust, specific impulse, chamber pressure, characteristic velocity, temperature sensitivity

Propellant Processing : Extrusion, casting pressing

Combustion: Gross and net calorific value - Explosive range - Calculation of minimum amount of air for combustion - Spontaneous ignition temperature - Flue gas analysis (Orsat apparatus).

SPECTROCHEMICAL TECHNIQUES IN MATERIAL CHARACTERISATION 9 Hours

Introduction to spectroscopy - Beer Lambert's Law.

Principle, instrumentation (block diagram only) and applications of: Colorimetric analysis (Estimation of concentration of Ferrous and copper ions in solutions), IR spectroscopy, Flame photometry, XRD, SEM.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Atkins, P. and de Paula, J., Atkins, Physical Chemistry, 9th edition., Oxford University Press, 2009.
2. Glasstone S., An introduction to Electrochemistry, 10th Edition, Affiliated to East West Press Private Limited, 2007.
3. Derek Pletcher and Frank C Walsh., Industrial Electrochemistry, Blackie Academic and Professional, London, 1993
4. Ahmed Z., Principles of Corrosion Engineering and Corrosion Control, Butterworth Heinemann, 2006.
5. David Linden & Thomas B. Reddy., Handbook of Batteries, 3rd edition, McGraw-Hill Companies, Inc. 2001
6. Revankar S.T., Majumdar P., Fuel Cell: Principles, Design and Analysis, CRC Press, 2014.
7. Samir Sarkar., Fuels and Combustion, 3rd Edition, Orient Longman, India, 2009.
8. Jain P.C. and Jain. M., Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2016.
9. Dara S.S. and Umare S.S., A text book of Engineering Chemistry, S.Chand and Company Limited, New Delhi, 2014.
10. Syed Shabudeen, P.S. and Shoba U.S., Engineering Chemistry, Inder Publishers, Coimbatore, 2013.
11. Sharma Y.R., Elementary Organic Spectroscopy, 5th Revised Edition, S.Chand and Company Limited, New Delhi, 2013.

U17CHT1003 Chemistry for Civil Engineering

L	T	P	J	C
3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Discuss Basic concepts of electrochemistry involved in corrosion (K3)

CO2: Defend the Corrosion problems (K1)

CO3: Design a water purifier (K2)

CO4: Discuss the properties of Refractories and Abrasives suitable for desired engineering application (K2)

CO5: Select proper Lubricant for different applications (K3)

CO6: Discuss the thermodynamic concepts and predict the feasibility of chemical reaction (K2)

Pre-requisites: NIL

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M					M						
CO2	S											
CO3	S	M				M						
CO4	M					M						
CO5	W											
CO6	M											

Course Assessment methods

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

ELECTROCHEMISTRY 9 Hours

Introduction - Electrode potential - Nernst equation and problems - Electrochemical series - Application of EMF measurements and problems - Kohlrausch law of independent migration of ions and its application.

Electrodes: Standard and Reference electrode (Hydrogen and Calomel) - Types of electrodes (Metal - Metal ion; Metal - Metal insoluble salt, Redox electrode) - Ion selective (glass electrode) - Determination of pH, pO_2, pCO_2 - Classification of electrochemical cell.

CORROSION SCIENCE 9 Hours

Corrosion: Principles and Mechanism of electrochemical corrosion - Factors influencing corrosion.

Types of corrosion: Galvanic corrosion - Differential aeration corrosion (pitting corrosion, water line corrosion) - Stress corrosion.

Corrosion control: Inhibitors - Dehumidifier gels - Cathodic protection (sacrificial anode) - Plating Techniques: Plating - Need for plating - Electroforming - Electropolishing - Electrochemical machining - Electrophoretic painting.

WATER TECHNOLOGY 9 Hours

Water hardness - Boiler feed water - formation of deposits in steam boilers and heat exchangers - Disadvantages (wastage of fuel, decrease in efficiency, priming, foaming, boiler explosion, boiler corrosion, caustic embrittlement) Prevention of scale formation: Internal treatment (phosphate, calgon, carbonate, colloidal),External treatment (Ion exchange method, desalination by reverse osmosis) - Treatment of common effluents.

ENGINEERING MATERIALS 9 Hours

Abrasives: Moh's scale of hardness - Natural abrasives (diamond, corundum, emery, [0- Application of abrasives.

Refractories: Characteristics - Classification (acid, basic and natural refractories) - Properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling)

Lubricants: Classification - Functions - Properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - Semi solid lubricant (greases with calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide)

THERMODYNAMICS 9 Hours

Introduction - Thermodynamic process (isothermic, isobaric, isochoric and adiabatic processes) - Internal energy - First law of thermodynamics (Mathematical derivation and limitation) - Second law of thermodynamics - Third law and Zeroeth law of thermodynamics (statements only) - Work function - Gibbs Helmholtz equation (derivation, applications & problems) - Van't Hoff isotherm (derivation & problems) - Van't Hoff isochore - (derivation & problems)

Theory: 45 Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours

REFERENCES

1. Atkins, P. and de Paula, J., Atkins, Physical Chemistry, 9th ed., Oxford Univ. Press, 2009.
2. Glasstone S., An introduction to Electrochemistry, 10th Edition, Affiliated to East West Press Private Limited, 2007.
3. Ahmed Z., Principles of Corrosion Engineering and Corrosion Control, Butterworth Heinemann, 2006.
4. Bahl B.S., Tuli G.D. and Arun Bahl., Essential of Physical Chemistry, S.Chand & Co. Ltd., New Delhi, 2015.

5. Syed Shabudeen, P.S. and Shoba U.S., Engineering Chemistry - I, Inder Publishers, Coimbatore, 2013
6. Jain P.C. and Jain. M., Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2017.
7. Syed Shabudeen P.S., Engineering Chemistry-II, Inder Publishers, Coimbatore, 2013
8. Ritwik Sarkar., Refractory Technology – Fundamental and Application, CRC Press, 2016

U17 CHT1001 Chemistry for Automobile Engineering

L	T	P	J	C
3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Discuss Basic concepts of electrochemistry involved in battery assembly (K2)

CO2: Apply the principle of electrochemistry and assemble a battery (K4)

CO3: Defend the Corrosion problems (K2)

CO4: Summarize different types of fuels and lubricants (K2)

CO5: Discuss basic concepts of combustion (K3)

CO6: Outline the principles and instrumentation of spectroscopic techniques involved in material characterization (K2)

Pre-requisites :

NIL

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M					M						
CO2	S											
CO3	M	M				M						
CO4	M		M			M						
CO5	S											
CO6	M											

Course Assessment methods

Direct

1. Continuous Assessment Test I, II
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation,Prototype or Product Demonstrationetc (as applicable)
3. End Semester Examination

Indirect

1. Course-end survey

ELECTROCHEMISTRY 9 Hours

Introduction - Electrode potential - Nernst equation and problems - Electrochemical series - Application of EMF measurements and problems - Kohlrausch law of independent migration of ions and its application.

Electrodes: Standard and Reference electrode (Hydrogen and Calomel) - Types of electrodes (Metal - Metal ion; Metal - Metal insoluble salt, Redox electrode) - Ion selective (glass electrode) - Determination of pH, pO_2, pCO_2 - Classification of electrochemical cell.

CORROSION SCIENCE 6 Hours

Corrosion: Principles and Mechanism of electrochemical corrosion - Factors influencing corrosion.

Types of corrosion: Galvanic corrosion - Differential aeration corrosion (pitting corrosion, water line corrosion) - Stress corrosion.
Corrosion control: Inhibitors - Dehumidifier gels - Cathodic protection (sacrificial anode) - Plating Techniques: Plating - Need for plating - Electroforming -Electropolishing - Electrochemical machining - Electrophoretic painting.

ENERGY STORING DEVICES 12Hours

Batteries: Factors for selection of batteries - Rating calculation using datasheet.
Primary Battery (Alkaline battery) - Secondary Battery (Lead acid storage battery, Nickel - Cadmium battery, Lithium ion battery and Lithium polymer battery) - Nuclear battery - Nano Battery
Flow battery: Introduction - Construction of Types of fuel cell
Solar Cells: Silicon Solar cells - Hybrid Solar cells - Dye sensitized solar cells - Tandem Solar cells.

FUELS: COMBUSTION AND LUBRICANTS 9 Hours

Fuels: Classification of fuels - Liquid Fuel: Manufacturing of synthetic petrol (Fischer Tropsch method)
Gaseous fuels: Production, composition and uses of producer gas, water gas and natural gas.
Combustion: Gross and net calorific value - Explosive range - Calculation of minimum amount of air for combustion - Spontaneous ignition temperature - Flue gas analysis (Orsat apparatus).
Lubricants: Classification - Functions - Properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - Semi solid lubricant (greases with calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide).

SPECTROCHEMICAL TECHNIQUES IN MATERIAL CHARACTERISATION 9 Hours

Introduction to spectroscopy - Beer Lambert's Law.
Principle, instrumentation (block diagram only) and applications of : Colorimetric analysis (Estimation of concentration of Ferrous and copper ions in solutions), IR spectroscopy, Flame photometry, XRD, SEM.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

12. Atkins, P. and de Paula, J. Atkins, Physical Chemistry, 9th ed., Oxford Univ. Press, 2009.
13. Glasstone S., An introduction to Electrochemistry, 10th Edition, Affiliated to East West Press Private Limited, 2007.
14. Derek Pletcher and Frank C Walsh., Industrial Electrochemistry, Blackie Academic and Professional, London, 1993
15. Ahmed Z., Principles of corrosion engineering and corrosion control, Butterworth Heinemann, 2006.
16. David Linden & Thomas B. Reddy., Handbook of Batteries, 3rd edition, McGraw-Hill Companies, Inc. 2001
17. Revankar S.T., Majumdar P., Fuel Cell: Principles, Design and Analysis, CRC Press, 2014.
18. Samir Sarkar., Fuels and Combustion, 3rd Edition , Orient Longman, India, 2009.
19. Jain P.C. and Jain. M., Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2013.

20. Dara S.S. and Umare S.S., A text book of Engineering Chemistry, S.Chand and Company Limited, New Delhi, 2014.
21. Syed Shabudeen, P.S. and Shoba U.S., Engineering Chemistry, Inder Publishers, Coimbatore, 2013
22. Sharma Y.R., Elementary Organic Spectroscopy, 5th Revised Edition, S.Chand and Company Limited, New Delhi, 2013.

U17CHT1002 Basic Concepts of Chemistry

L	T	P	J	C
3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Discuss Basic concepts of electrochemistry (K3)
CO2: Explain the laws of thermodynamics (K2)
CO3: Prepare the solutions of required concentration (K2)
CO4: Explain the concepts of buffer (K3)
CO5: Explain the basic concepts of bonding in organic compounds (K2)
CO6: Outline the basics of Organic Chemistry (K2)

Pre-requisites :

NIL

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M											
CO2	S											
CO3	M											
CO4	M											
CO5	S											
CO6	M											

Course Assessment methods

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation,Prototype or Product Demonstrationetc (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

ELECTROCHEMISTRY 9 Hours

Introduction - Electrode potential - Nernst equation and problems - Electrochemical series - Application of EMF measurements and problems - Conductometric titrations (acid - base and precipitation titration)

Electrodes: Standard and Reference electrode (Hydrogen and Calomel) -Types of electrodes (Metal - Metal ion; Metal - Metal insoluble salt, Redox electrode) - Ion selective (glass electrode) - determination of pH using glass electrode

Cells: Galvanic cell - Types of concentration cells

BASICS OF THERMODYNAMICS 9 Hours

Introduction - Thermodynamic process (isothermic, isobaric, isochoric and adiabatic processes) - Internal energy - First law of thermodynamics (Mathematical derivation and limitation) - Enthalpy - Endothermic, Exothermic reactions - Second law of

thermodynamics - Hess laws and problems - work function - Gibbs Helmholtz equation (derivation, applications and problems) - Van't Hoff isotherm (derivation and problems) - Van't Hoff isochore - (derivation and problems) - Third law and Zeroeth law (Only statements) - Energy changes in biochemical reactions.

SOLUTION CHEMISTRY 9 Hours

Basics of Chemical reactions and problems - oxidation-reduction reactions and its importance in biological system energy generation - Intermolecular interactions of Solids, liquid and gases - Types of solutions - Expressing concentration of solutions (Problems) - Concentration of ions and organic compounds in cells and blood.

Acids, Bases and Buffers

Arrhenius concept - Bronsted concept - Lewis concept - Ionic product of water - Strengths of acids and bases - pH scale - Common ion effect - Buffer solutions - Buffer capacity - Calculation of pH values of buffer mixtures - Henderson - Hasselbach equation.

CHEMICAL BONDING 9 Hours

Bonding: Introduction - Ionic bonding - **V**an der Waal's forces (dipole - dipole, dipole - induced dipole, induced dipole - induced dipole interactions) - hydrophobic interaction

Bonding in organic molecules: covalent and co-ordinate bonds (overview only) - hybridization (sp, sp^2, sp^3, sp^3d, sp^3d^2 in simple molecules) - hydrogen bonding and its consequences.

INTRODUCTION TO ORGANIC CHEMISTRY 9 Hours

Introduction - Common organic functional groups - Naming of organic compounds - Resonance concept - Aromatic and aliphatic molecules - Classification and mechanism of organic reactions - Electrophiles and Nucleophiles - Carbocation and Carbanion - Nucleophilic substitution reaction (SN1, SN2) - Elimination reactions (E1 & E2) reactions.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Atkins, P. and de Paula, J., Atkins, Physical Chemistry, 9th ed., Oxford Univ. Press, 2009.
2. Glasstone S., An introduction to Electrochemistry, 10th Edition, Affiliated to East West Press Private Limited, 2007.
3. Jain P.C. and Jain. M., Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2013.
4. Syed Shabudeen, P.S. and Shoba U.S., Engineering Chemistry, Inder Publishers, Coimbatore, 2013
5. Bahl B.S., Tuli G.D. and ArunBahl., Essential of Physical Chemistry, S.Chand & Co. Ltd., New Delhi, 2014
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, S. Nagin Chand & Co., New Delhi, 2009
7. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, S. Chand & Co., New Delhi (2012)
8. McMurry J., Organic Chemistry, Brooks Cole, 7th Edition, (2007)

U17CHT2004 Chemistry for Biotechnology

L	T	P	J	C
3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Outline the basic concepts of Stereochemistry (K3)
CO2: Discuss the chemical concepts of Carbohydrates (K2)
CO3: Discuss the importance of Carbohydrates in real life situations (K3)
CO4: Discuss the chemistry of lipids (K2)
CO5: Discuss the biological role of steroids (K2)
CO6: Discuss the theory of amino acids (K2)

Pre-requisites :

NIL

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M											
CO2	S											
CO3	M											
CO4	M											
CO5	S											
CO6	M											

Course Assessment methods

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation,Prototype or Product Demonstrationetc (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

INTRODUCTION TO STEREOCHEMISTRY 9 Hours

Isomerism: Introduction and classification of isomerism
Structural isomerism: Definition - chain - position - functional -tautomerism
Conformational isomerism: Definition - in simple organic molecules
Notation: d and l; R and S; E and Z notation of simple organic molecules
Geometrical isomerism: Definition - in alkenes and cyclopropanes
Optical isomerism: Definition and conditions of optical isomerism - optical activity - chirality-optical isomerism in tartaric and lactic acids - optical activity without asymmetric carbon (allelenes, Biphenyl derivatives) - definition of enantiomers, diastereomers, mesocompounds, racemic mixture, Walden inversion.

CHEMISTRY OF CARBOHYDRATES 12 Hours

Introduction - Classification - Isomerism in Carbohydrates - Sources and Biochemical Importance of Carbohydrates - Reactions of Monosaccharide - Structure and functions of Monosaccharide, Disaccharides and Polysaccharides - Glycoprotein.

CHEMISTRY OF LIPIDS 14 Hours

Introduction - Classification of lipids - Function of lipids - Nomenclature of fatty acids - Biochemically important fatty acids (Saturated and Unsaturated Fatty Acids, Essential Fatty Acids) - Properties of Triacylglygerol - Tests to check purity of Fats and Oils - Steroids: Structure of steroid nucleus - Biological role of cholesterol and ergosterol

CHEMISTRY OF AMINOACIDS 10 Hours

Introduction To Amino Acids - Naturally Occurring Amino Acids And Their R Groups - Amino Acid As Zwitter Ion - Reactions Of Carboxyl And Amino Groups Of Amino Acid, Chemical Synthesis Of Amino Acids: Streckers Synthesis, Nucleophilic Substitution Reaction - Protecting Group For Amino Acids - Role Of Base Stacking In Structural Organization Of Proteins And Nucleic Acids – Solid Phase Peptide Synthesis.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Finar I.L, Organic chemistry, Pearson Publishers, UK, 2012
2. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th edition Blackwell Publishing, London, 2000
3. Syed Shabudeen P.S. and Shoba U.S., Chemistry for Textiles, Inder publications, Coimbatore, 2014
4. Bahl B.S. and Arun Bahl., Advanced *Organic Chemistry*, S. Chand & Co., New Delhi, 2014
5. Nelson, D.L and Cox M.M Lehninger Principles of Biochemistry, W. H. Freeman & CO, New York, 2012
6. Satyanarayana U., Biochemistry, Elsevier India, 2013
7. McMurry J., Organic Chemistry, 7th Edition, Brooks Cole, (2007)
8. McMurry J., Organic Chemistry with biological applications, Brooks Cole, (2011)

U17CHT1008 **Chemistry for Mechatronics Engineering**

L	T	P	J	C
3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Discuss Basic concepts of electrochemistry involved in corrosion (K3)

CO2: Defend corrosion problems (K3)

CO3: Apply the principle of electrochemistry and assemble a battery (K3)

CO4: Select conducting polymers for a particular application(K2)

CO5: Outline about PCB and discuss the process of PCB fabrication (K2)

CO6: Apply the concepts of etching and plating in developing printed circuit boards (K3)

Pre-requisites :

NIL

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M					M						
CO2	M											
CO3	W	M				M						
CO4	S		M			M						
CO5	S											
CO6	M											

Course Assessment methods

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation,Prototype or Product Demonstrationetc (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

ELECTROCHEMISTRY 9 Hours

Introduction - Electrode potential - Nernst equation and problems - Electrochemical series - Application of EMF measurements and problems - Kohlrausch law of independent migration of ions and its application

Electrodes: Standard and Reference electrode (Hydrogen and Calomel) - Types of electrodes (Metal - Metal ion; Metal – Metal insoluble salt, Redox electrode) - Ion selective (glass electrode) - Determination of pH, pO_2, pCO_2 - Classification of electrochemical cell

CORROSION SCIENCE 6 Hours

Corrosion: Principles and Mechanism of electrochemical corrosion - Factors influencing corrosion.

Types of corrosion: Galvanic corrosion - Differential aeration corrosion (pitting corrosion, water line corrosion) - Stress corrosion.
Corrosion control: Inhibitors - Dehumidifier gels - Cathodic protection (sacrificial anode) - Plating Techniques: Plating - Need for plating - Electroforming -Electropolishing - Electrochemical machining - Electrophoretic painting

ENERGY STORING DEVICES 12 Hours

Batteries: Factors for selection of batteries - Rating calculation using datasheet.
Primary Battery (Alkaline battery) - Secondary Battery (Lead acid storage battery, Nickel - Cadmium battery, Lithium ion battery & Lithium polymer battery) - Nuclear battery-Nano battery.
Flow battery: Introduction - Construction of Types of fuel cell
Solar Cells: Silicon Solar cells - Hybrid Solar cells - Dye sensitized Solar cells - Tandem Solar cells.

CONDUCTING POLYMERS 12 Hours

Electron conducting polymers: Synthesis, Structure, Properties and Application of polyacetylene, polyphenylene, poly aniline, polypyrrole and polythiophine.
Introduction - Polymer types - Conducting Polymers - Nature of doping process - Theory of conductivity.
Electron conducting polymers: Synthesis, Structure, Properties and Application of polyacetylene, poly aniline, polyphenylene, polythiophine, polypyrrole & indole carbazole.

BASICS OF PRINTED CIRCUIT BOARDS 6 Hours

Introduction- Components of PCB - Flexible printed circuit boards (an overview)
Chemistry of Laminates in PCB: Properties and Types
Etching Techniques: Chemistry of Etching Solutions - electrochemical etching of Cu from PCBs.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Periods

REFERENCES

23. Atkins, P. and de Paula, J., Atkins, Physical Chemistry, 9th ed., Oxford Univ. Press, 2009.
24. Glasstone S., An introduction to Electrochemistry, 10th Edition, Affiliated to East West Press Private Limited, 2007.
25. Derek Pletcher and Frank C Walsh., Industrial Electrochemistry, Blackie Academic and Professional, London, 1993.
26. Ahmed Z., Principles of Corrosion Engineering and Corrosion Control, Butterworth Heinemann, 2006.
27. David Linden & Thomas B. Reddy., Handbook of Batteries, 3rd edition, McGraw-Hill Companies, Inc. 2001
28. Revankar S.T., Majumdar P., Fuel Cell: Principles, Design and Analysis, CRC Press, 2014.
29. Syed Shabudeen, P.S. and Shoba U.S., Engineering Chemistry, Inder Publishers, Coimbatore, 2014
30. Jain P.C. and Jain. M., Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2017.
31. Seymour R.B. and Carraher C.E. Jr, Polymer chemistry, 6th Edition, Plenum Pub. Corporation, New York, 2003.
32. Terje A. Skotheim and John R. Reynolds, The Handbook of Conducting Polymers in

Conjugated polymers theory, synthesis, properties and characterization, 3rd Edition, CRC Press, 2006
33. Khandpur R.S., Printed Circuit Boards Design, Fabrication and Assembly, McGraw-Hill Publishing Company Limited., New Delhi, 2005

U17CHT1007 **Chemistry for Mechanical Engineering**

L	T	P	J	C
3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Discuss Basic concepts of electrochemistry involved in corrosion (K3)
CO2: Defend the Corrosion problems (K3)
CO3: Apply the principle of electrochemistry and assemble a battery (K3)
CO4: Summarize different types of fuels and analyse the flue gas (K3)
CO5: Select lubricants for desired engineering application (K2)
CO6: Select proper engineering materials for desired engineering application (K2)

Pre-requisites :

NIL

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	M					M						
CO2	M											
CO3	M	M				M						
CO4	S		M			M						
CO5	S											
CO6	M											

Course Assessment methods

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

ELECTROCHEMISTRY 9 Hours

Introduction - Electrode potential - Nernst equation and problems - Electrochemical series - Application of EMF measurements and problems - Kohlrausch law of independent migration of ions and its application

Electrodes: Standard and Reference electrode (Hydrogen and Calomel) - Types of electrodes (Metal - Metal ion; Metal - Metal insoluble salt, Redox electrode) - Ion selective (glass electrode) - Determination of pH, pO_2, pCO_2 - Classification of electrochemical cell.

CORROSION SCIENCE 6 Hours

Corrosion: Principles and Mechanism of electrochemical corrosion - Factors influencing corrosion

Types of corrosion: Galvanic corrosion - Differential aeration corrosion (pitting corrosion, water line corrosion) - Stress corrosion

Corrosion control: Inhibitors - Dehumidifier gels - Cathodic protection (sacrificial anode) - Plating Techniques: Plating - Need for plating - Electroforming - Electropolishing - Electrochemical machining - Electrophoretic painting

ENERGY STORING DEVICES 12 Hours

Batteries: Factors for selection of batteries - Rating calculation using datasheet.

Primary Battery (Alkaline battery) - Secondary Battery (Lead acid storage battery, Nickel - Cadmium battery, Lithium ion battery and Lithium polymer battery) - Nuclear battery-Nano battery.

Flow battery: Introduction - Construction of types of fuel cell

Solar Cells: Silicon Solar cells - Hybrid Solar cells - Dye sensitized Solar cells - Tandem Solar cells.

FUELS AND COMBUSTION 9 Hours

Fuels: Classification of fuels - Solid fuel: Coal varieties - Analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only)

Liquid Fuel: Manufacturing of synthetic petrol (Fischer Tropschmethod)

Gaseous fuels: Production, composition and uses of producer gas, water gas and natural gas.

Combustion: Gross and net calorific value - Explosive range - Calculation of minimum amount of air for combustion - Spontaneous ignition temperature - Flue gas analysis (Orsat apparatus)

MECHANICAL ENGINEERING MATERIALS 9 Hours

Refractories: Characteristics - Classification (acid, basic and natural refractories) - Properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling)

Lubricants: Classification - Functions - Properties (viscosity index, flash and fire point, oiliness, carbon residue, aniline point, cloud and pour point) - Semi solid lubricant (greases with calcium based, sodium based, lithium based) - solid lubricants (graphite, molybdenum disulphide)

Abrasives: Moh's scale of hardness - Natural abrasives (diamond, corundum, emery, garnets and quartz) - Artificial abrasives (Silicon carbide, Boron carbide, Alundum) - Application of abrasives

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

34. Atkins, P. and de Paula, J., Atkins, Physical Chemistry, 9th ed., Oxford Univ. Press, 2009.
35. Glasstone S., An introduction to Electrochemistry, 10th Edition, Affiliated to East West Press Private Limited, 2007.
36. Derek Pletcher and Frank C Walsh., Industrial Electrochemistry, Blackie Academic and Professional, London, 1993
37. Ahmed Z., Principles of Corrosion Engineering and Corrosion Control, Butterworth Heinemann, 2006.

38. David Linden & Thomas B. Reddy., Handbook of Batteries, 3rd edition, McGraw-Hill Companies, Inc. 2001
39. Revankar S.T., Majumdar P., Fuel Cell: Principles, Design and Analysis, CRC Press, 2014.
40. Samir Sarkar., Fuels and Combustion, 3rd Edition, Orient Longman, India, 2009.
41. Jain P.C. and Jain. M., Engineering Chemistry, 16th Edition, DhanpatRai Publishing Company, New Delhi, Reprint 2017.
42. Dara S.S. and Umare S.S., A text book of Engineering Chemistry, S.Chand and Company Limited, New Delhi, 2014.
43. Syed Shabudeen, P.S. and Shoba U.S., Engineering Chemistry, Inder Publishers, Coimbatore, 2013.
44. RitwikSarkar, Refractory Technology – Fundamental and application, CRC Press, 2016

U17CHT1005 Chemistry for Electrical Engineering

L	T	P	J	C
3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Discuss Basic concepts of electrochemistry involved in corrosion

CO2: Defend corrosion problems

CO3: Apply the principle of electrochemistry and assemble a battery

CO4: Discuss the thermodynamic concepts and predict the feasibility of chemical reaction

CO5: Outline about PCB and discuss the process of PCB fabrication

CO6: Apply the concepts of etching and plating in developing printed circuit boards

Pre-requisites :

NIL

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					M						
CO2	M											
CO3	W	M				M						
CO4	S		M			M						
CO5	S											
CO6	M											

Course Assessment methods

Direct
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc. (as applicable) 3. End Semester Examination
Indirect
1. Course-end survey

ELECTROCHEMISTRY 9 Hours

Introduction - Electrode potential - Nernst equation and problems - Electrochemical series - Application of EMF measurements and problems - Kohlrausch law of independent migration of ions and its application - Conductivity of electrolytes - Specific, molar and equivalent conductivity.

Electrodes: Standard and Reference electrode (Hydrogen and Calomel) - Types of electrodes (Metal - Metal ion; Metal - Metal insoluble salt, Redox electrode) - Ion selective (glass electrode) - Classification of electrochemical cell.

CORROSION SCIENCE 6 Hours

Corrosion: Principles and Mechanism of electrochemical corrosion - Factors influencing corrosion

Types of corrosion: Galvanic corrosion - Differential aeration corrosion (pitting corrosion, water line corrosion) - Stress corrosion

Corrosion control: Inhibitors - Dehumidifier gels - Cathodic protection (sacrificial anode) - Plating Techniques: Plating - Need for plating - Electroforming - Electro polishing - Electrochemical machining - Electrophoretic painting

ENERGY STORING DEVICES 12 Hours

Batteries: Factors for selection of batteries - Rating calculation using datasheet.
Primary Battery (Alkaline battery) - Secondary Battery (Lead acid storage battery, Nickel - Cadmium battery, Lithium ion battery and Lithium polymer battery) - Nuclear battery-Nano battery
Flow battery: Introduction - Construction of types of fuel cell
Solar Cells: Silicon Solar cells - Hybrid Solar cells - Dye sensitized Solar cells - Tandem Solar cells.

THERMODYNAMICS 3 Hours

Introduction - Thermodynamic process (isothermic, isobaric, isochoric and adiabatic processes) - Internal energy - First law of thermodynamics (Mathematical derivation and limitation) - Second law of thermodynamics - Third law and Zeroeth law of thermodynamics - Work function - Ficks law of diffusion

CONDUCTING POLYMERS 9 Hours

Introduction - Polymer types - Conducting Polymers - Nature of doping process - Theory of conductivity
Synthesis, Structure, Properties and Application of Polyaniline and Polythiophene

BASICS OF PRINTED CIRCUIT BOARDS: 6 Hours

Introduction - Components and Types of PCB – Advantages and Disadvantages
Flexible printed circuit boards (an overview)
Process involved in PCB : Subtractive process – Additive process – Etching - Electrochemical etching of Cu from PCB

Theory: 45 Tutorial: 0 Practical: 0 Project: 0 Total: 45 Hours

REFERENCES

45. Atkins, P. and de Paula, J., Atkins, Physical Chemistry, 9th ed., Oxford Univ. Press, 2009.
46. Glasstone S., An introduction to Electrochemistry, 10th Edition, Affiliated to East West Press Private Limited, 2007.
47. Derek Pletcher and Frank C Walsh., Industrial Electrochemistry, Blackie Academic and Professional, London, 1993.
48. Ahmed Z., Principles of Corrosion Engineering and Corrosion Control, Butterworth Heinemann, 2006.
49. David Linden & Thomas B. Reddy., Handbook of Batteries, 3rd edition, McGraw-Hill Companies, Inc. 2001
50. Revankar S.T., Majumdar P., Fuel Cell: Principles, Design and Analysis, CRC Press, 2014.
51. Syed Shabudeen, P.S. and Shoba U.S., Engineering Chemistry, Inder Publishers, Coimbatore, 2014
52. Jain P.C. and Jain. M., Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, Reprint 2017.

53. Seymour R.B. and Carraher C.E. Jr, Polymer chemistry, 6th Edition, Plenum Pub. Corporation, New York, 2003.
54. Terje A. Skotheim and John R. Reynolds, The Handbook of Conducting Polymers in Conjugated polymers theory, synthesis, properties and characterization, 3rd Edition, CRC Press, 2006
55. Khandpur R.S., Printed Circuit Boards Design, Fabrication and Assembly, McGraw-Hill Publishing Company Limited., New Delhi, 2005

U17CHP1501

Chemistry Laboratory

(COMMON TO ECE, E&I, EEE, FT & ME)

L	T	P	J	C
0	0	2	0	1

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Prepare standard solutions

CO2: Analyse the properties of water by applying the chemical concepts

CO3: Analyse the solutions by electrochemical techniques and apply it in real life situations like corrosion, soil, water testing etc.

CO4: Analyse the solutions by spectroscopic techniques and apply it in real life situations like corrosion, soil, water testing etc.

Pre-requisites :

NIL

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2	M											
CO3	M					M						
CO4	M					M						

Course Assessment methods

Direct
1. Post-experiment Test/Viva; Experimental Report for each experiment; Model Examination 2. End Semester Examination
Indirect
1. Course-end survey

List of Experiments

30 Hours

1. Preparation of normal solutions of the following substances - Sodium carbonate, Hydrochloric acid and Buffer solution

WATER TESTING

2. Determination of total, temporary and permanent hardness by EDTA method.
3. Estimation of DO by Winkler's method
4. Estimation of alkalinity by Indicator method.
5. Estimation of chloride by Argentometric method.

ELECTRO CHEMICAL ANALYSIS

6. Estimation of hydrochloric acid by pH metry.
7. Conductometric estimation of mixture of acids and strong base
8. Estimation of corrosion of Iron by Potentiometry

PHOTOMETRY

9. Estimation of the extent of dissolution of Copper / Ferrous ions by Spectrophotmetry.

10. Estimation of sodium and potassium in water by Flame photometry.

DEMONSTRATION

11. Determination of Fire point and Flash point
12. Determination of Cloud and Pour point
13. Microscopic usage in Metallurgy.
14. Determination of Molecular weight by Viscometer

Theory: 0 Tutorial: 0 Practical: 30 Project: 0 Total: 30 Hours

REFERENCES

1. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book of Quantitative Chemical Analysis, Oxford, ELBS, London, 2012.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, Tata McGraw-Hill Pub. Co., Ltd., London, 2003.
3. Shoba U.S., Sivahari R. and Mayildurai R., Practical Chemistry, Inder Publications, Coimbatore, 2011.

U17CHP2501 **Chemistry Laboratory (COMMON TO AE, AU, BIO, CE & MCE)**

L	T	P	J	C
0	0	2	0	1

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Prepare standard solutions (S1)

CO2: Analyse the properties of water by applying the chemical concepts (S2)

CO3: Analyse the solutions by electrochemical techniques and apply it in real life situations like corrosion, soil, water testing etc (S2)

CO4: Analyse the solutions by spectroscopic techniques and apply it in real life situations like corrosion, soil, water testing etc (S2)

Pre-requisites :

NIL

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2	M											
CO3	M					M						
CO4	M					M						

Course Assessment methods

Direct
1. Post-experiment Test/Viva; Experimental Report for each experiment; Model Examination 2. End Semester Examination
Indirect
1. Course-end survey

List of Experiments **30 hours**

1. Preparation of normal solutions of the following substances - Sodium carbonate, Hydrochloric acid and Buffer solution

WATER TESTING

2. Determination of total, temporary and permanent hardness by EDTA method.
3. Estimation of DO by Winkler's method
4. Estimation of alkalinity by Indicator method.
5. Estimation of chloride by Argentometric method.

ELECTRO CHEMICAL ANALYSIS

6. Estimation of hydrochloric acid by pH metry.
7. Conductometric estimation of mixture of acids and strong base
8. Estimation of corrosion of Iron by Potentiometry

PHOTOMETRY

9. Estimation of the extent of dissolution of Copper / Ferrous ions by Spectrophotmetry.
10. Estimation of sodium and potassium in water by Flame photometry.

DEMONSTRATION

11. Determination of Fire point and Flash point
12. Determination of Cloud and Pour point
13. Microscopic usage in Metallurgy.
14. Determination of Molecular weight by Viscometer

Theory: 0 Tutorial: 0 Practical: 30 Project: 0 Total: 30 Hours

REFERENCES

1. Jeffery G.H., Bassett J., Mendham J. and Denny R.C., Vogel's Text Book of Quantitative Chemical Analysis, Oxford, ELBS, London, 2012.
2. Shoemaker D.P. and C.W. Garland., Experiments in Physical Chemistry, Tata McGraw-Hill Pub. Co., Ltd., London, 2003.
3. Shoba U.S., Sivahari R. and Mayildurai R., Practical Chemistry, Inder Publications, Coimbatore, 2011.