STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI-600086.

Post Graduate Elective Course Offered by the Department of Chemistry for M.A. / M.Sc. / M.Com Degree Programme

SYLLABUS

(Effective from the academic year 2019- 2020)

COSMETICS AND HERBAL PRODUCTS

CODE: 19CH/PE/CH23 **CREDITS: 3**

L T P: 3 0 0

TOTAL TEACHING HOURS: 39

OBJECTIVES OF THE COURSE

- To expose the students to the concept of cosmetology and human anatomy
- To instill a keen interest in students towards personal care
- To enlighten students on the importance of natural herbal products and remedies for beauty care

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- Classify cosmetics and identify the various ingredients present in cosmetics
- Appreciate the importance of skin care in the maintenance of good health
- Choose the proper beauty product for both skin and hair maintenance
- Identify the different types of beauty treatments available for different skin types
- Appreciate the importance of natural herbal products for beauty care

Unit 1 **(6 Hours)**

Cosmetology

1.1 Cosmetics- Definition, purpose, classification, significance.
1.2 History of Cosmetics – Cosmetology, cosmeceuticals, therapeutics
1.3 Ingredients present in cosmetics – Water, emulsifier, preservative, thickener, emollient, colour, fragrance and pH stabilizer
1.4 Quality characteristics – Regulation and Safety

Unit 2 **(8 Hours)**

Skin care

2.1 Skin- structure and functions- pH and moisture balance, maintenance of skin
2.2 Types of skin: dry skin, oily skin, wrinkled skin
2.3 Cleansing of the skin, creams and lotions, astringent and skin tonics, skin lighteners, depilatories, food habits related to skin care.

Unit 3 **(8 Hours)**

Scalp and Hair Treatments

3.1 Structure of hair, growth and type of hair,
3.2 Shampoos and conditioners, hair styling products, hair ironing and methods of colouring / dyeing - Precautionary measures
3.3 Personal care and cleanliness of hair.

Unit 4 **(8 Hours)**

Beauty Treatments

4.1 Facials-types-advantages and disadvantages,
4.2 Lipstick, eyeliner, mascara, eye shadow - chemical composition
4.3 AHA exfoliation, Facials: galvanic, high frequency, aroma therapy
4.4 Toxicology of cosmetics

Unit 5 **(9 Hours)**

Herbal Cosmetics

5.1 Nomenclature, characteristics and classification of herbs used for hair care.
5.2 Hair cleansing: Shikakai, Amla. Hair growth: Brahmi, Manjistha
5.3 Anti-dandruff: Tulsi, Neem, Wheat Gram Oil
5.4 Fruits and Vegetables as skin care - Carrot, Cucumber, honey, lemon, mint, tomato, yogurt and tea
5.5 Use of herbs and their incorporation in cosmetics formulation

BOOKS FOR STUDY

Gem Mathew, G.D., *Chemistry in Everyday Life*, Vishal Publishers, 2014
Wilkinson J B E and Moore R J, *Harry's Cosmetology*, London, Chemical Publishers, 2000

BOOKS FOR REFERENCE

T. Mitsui, *New Cosmetic Science*, Elsevier, 1997.
André O. Barel, Marc Paye, Howard I. Maibach, *Handbook of Cosmetic Science and Technology*, CRC Press, 2014.
NIIR Board, *Handbook on Herbal Products (Medicines, Cosmetics, Toiletries, Perfumes) Vol. 2*, National Institute of Industrial Research, 2002.

JOURNALS

International journal of cosmetic science
Cosmetics, Dermatological Sciences and Applications

WEB RESOURCES

https://cosmeticsinfo.org
https://www.encyclopedia.com/sports-and-everyday-life/fashion-and.../cosmetics

PATTERN OF ASSESSMENT

Continuous Assessment Test: **Total Marks: 50** **Duration: 90 minutes**
Section A – 11 x 1 = 11 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match and answer in a line or two)
Section B – 3 x 8 = 24 Marks (3 out of 4 to be answered)
Section C – 1 x 15 = 15 Marks (1 out of 2 to be answered)
Other Components: **Total Marks: 50**
Quiz/Problem Solving/Seminars/Assignments
End-Semester Examination: **Total Marks: 100** **Duration: 3 Hours**

Section A – 20 x 1 = 20 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match and answer in a line or two)
Section B – 5 x 8 = 40 Marks (5 out of 7 to be answered)
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Post Graduate Elective Course Offered by the Department of Chemistry for M.A. / M.Sc. / M.Com Degree Programme

SYLLABUS

(Effective from the academic year 2019-2020)

FOOD CHEMISTRY AND NUTRITION

CODE:19CH/PE/FN23 **CREDITS:3**

L T P:3 0 0

TOTAL TEACHING HOURS:39

OBJECTIVES OF THE COURSE

- To equip the students on the effective usage of the food guide
- To educate on the chemistry of different constituents of food like carbohydrates, proteins and vitamins
- To give an introduction about the various nutrients, their nutritional value, functions and storage

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- Identify the five food groups and learn to create a personal food guide
- Illustrate the importance of the recommended dietary allowance in planning their daily meals
- Distinguish between the different types of fats and their functions
- Recall the importance of carbohydrates as an important energy giving food source
- Compare the functions and biological importance of vitamins and minerals
- Discuss the crucial role of protein in the daily diet and the consequences of protein malnutrition
- Recognize the role of national and international bodies involved in combating malnutrition

Unit 1 **(8 Hours)**

Introduction to Food Chemistry and Nutrition

1.1 Food Guide- Basic Five Food Groups, Usage of the Food Guide

1.2 Introduction to Nutrition –Definition of Nutrition and Nutrients, Interrelationship between Nutrition and Health, Malnutrition. Basal Metabolism and Determination of BMR

1.3 Recommended Dietary Allowances (RDA) - Factors affecting RDA, General Principles of Deriving RDA, Determination of RDA of Different Nutrients

Unit 2 **(8 Hours)**

Carbohydrates and Lipids

2.1 Sources, Classification, Functions and Recommended Dietary Allowance of Carbohydrates. Glycemic index. Artificial Sweetening Agents

2.2 Effect of Cooking on Carbohydrates and Storage of Carbohydrates

2.3 Lipids: Sources, Chemical Classification, Functions. Essential Fatty Acids.

Unit 3 **(8 Hours)**

Minerals and Vitamins

3.1 Sources, Functions, Deficiency and Recommended Dietary Allowance of following Minerals: Calcium, Iron, Iodine and Phosphorous

3.2 Vitamins- Classification, Sources, Functions and Deficiency (Elementary Treatment) of the following Vitamins: Fat Soluble Vitamins- A, D, E and K , Water Soluble Vitamins- Ascorbic Acid, Thiamine, Riboflavin, Niacin, other members of B-Complex such as B_6, Folic Acid and B_{12}

3.3 Effect of Cooking on Vitamins and Minerals

Unit 4 **(8 Hours)**

Proteins

4.1 Sources, Classification, Functions, Nutritional Classification and Recommended Dietary Allowance of Proteins

4.2 Protein Energy Malnutrition (PEM) –Marasmus and Kwashiorkor. Steps that can be taken to aid in the Prevention of PEM

Unit 5 **(7 Hours)**

Role of International and National Agencies in Combating Malnutrition

5.1 International Agencies- World Health Organisation, Food and Agriculture Organization, United Nations Children's Fund

5.2 National Agencies-Indian Council of Agricultural Research (ICAR), Indian Council of Medical Research (ICMR), National Institute of Nutrition, Food and Nutrition Board

5.3 Nutrition Education- Methods used in Nutrition Education

BOOKS FOR STUDY

Fennema , R .Owen. *Food Chemistry*. New York: Marcel Decker, 2007.
Srilaksmi, B. *Nutrition Science*. New Delhi: New Age International, 2012.

BOOKS FOR REFERENCE

Potter, N. Norman. *Food Science*. New Delhi: CBS, 2007.
Mayer, William Hogoland. *Food Chemistry*. New Delhi: CBS, 2009.
Manay, Shankunthala N., Shadaksharswamy, M. *Food –Facts and Principles*. Chennai: New Age International, 2001.

JOURNALS

Journal of Nutrition
Journal of Food Science
Proceedings of Nutrition Society of India

WEB RESOURCES

www.wadsworth.com/nutrition/prod/allprod.html
www.ninindia.org
http:/www.nalusda.gov/fnic.html
www.who.org

PATTERN OF ASSESSMENT

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Section B – 3 x 8 = 24 Marks (3 out of 4 to be answered)
Section C – 1 x 15 = 15 Marks (1 out of 2 to be answered)

Other Components: Total Marks: 50
Quiz/Problem Solving/Seminars/Assignments

End-Semester Examination: Total Marks: 100 Duration: 3 hours
Section A – 20 x 1 = 20 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match and answer in a line or two)
Section B – 5 x 8 = 40 Marks (5 out of 7 to be answered)
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Post Graduate Elective Course Offered by the Department of Chemistry for M.A. / M.Sc. / M.Com Degree Programme

SYLLABUS
(Effective from the academic year 2019-2020)

MEDICINES AND HEALTH CARE

CODE:19CH/PE/MH23 **CREDITS: 3**
L T P:3 0 0
TOTAL TEACHING HOURS:39

OBJECTIVES OF THE COURSE

- To give an overview of medicines in day to day life - a field of interest to humanity
- To enlighten students on the different types of drugs used for the treatment of various diseases

COURSE LEARNING OUTCOMES
On successful completion of the course, students will be able to

- Identify the various terms involved in Pharmacy and Pharmacology
- Distinguish between various diseases and their treatment methods
- Demonstrate the importance of everyday essential drugs
- List the drugs of importance and their role in the treatment of various diseases

Unit 1 **(5 Hours)**

General Introduction to Drugs

1.1 Terminology- Pharmacy, Pharmacology, Pharmacodynamics, Pharmacokinetics, Antimetabolites, Mutation, Pharmacognosy, Toxicology, Pharmacotherapeutics, Chemotherapy, therapeutic index
1.2 Chemical Classification of Drugs

1.3 Diseases – Communicable and Non Communicable, Pathogens – Bacteria, Virus, Fungi, Protozoans

Unit 2 **(8 Hours)**

Common Diseases and their Treatment by Drugs

2.1 Common Diseases: Insect borne -Malaria, Air Borne - Whooping Cough, measles, common cold and TB. Waterborne - Cholera, Typhoid, Dysentery- Etiology, Symptoms, Prevention and Remedy

2.2 Common Disorders of the Digestive System – Hepatitis A and B; Respiratory system- Asthma; Nervous system- Epilepsy. Prevention and Treatment.

2.3 AIDS, HIV1, HIV2 – Awareness, Prevention and Treatment

Unit 3 **(8 Hours)**

Blood and Hematological Agents

3.1 Blood Pressure, Hypertension-Cause, Diet, Prevention. Antihypertensive Agents - Aldomet, Reserpine

3.2 Clotting of Blood- Mechanism, Haematological Agents, Anaemia –Causes and Control- Antianaemic Drugs

Unit 4 **(8 Hours)**

Drugs in Daily Life

4.1 Anaesthetics- Types-General, Local, Intravenous – (Ether, $CHCl_3$, Halothane, Nitrous Oxide, Cocaine), - Advantages and Disadvantages

4.2 Antiseptics and Disinfectants- (Phenols, Chloramines, Bleaching Powder, Dyes- Crystal Violet)

4.3 Analgesics, Antipyretic and Anti-Inflammatory Agents- Narcotic and Non-Narcotic Drugs-Morphine, Source, Activity and uses – Aspirin, Paracetamol

Unit 5 **(10 Hours)**

Drugs of Importance

5.1 Antibiotics-Classification - Therapeutic uses of Chloramphenicol, Penicillin- Potency of the Drug, (Streptomycin, Tetracyclines, Erythromycin)

5.2 Antipsychotic Drugs- Tranquiliser (Piperazine, Benzamides), Adverse effects; Antidepressants-Sedatives and Hypnotics - Barbiturates

5.3 Diabetes – Types – Hypoglycemic Agents, Sugar Substitutes. Cancer -Causes - Types – Treatments - Antineoplastic Drugs - Antimetabolites and Plant Products

BOOKS FOR STUDY

Craig, R., Robert. E., Stitzel. *Modern Pharmacology*.USA: Little Brown, 2004.

Ghosh , Jayashree. *A Text book of Pharmaceutical Chemistry*. New Delhi: S.Chand ,1997.

BOOKS FOR REFERENCE

Sundari, K. Bagavathi. *Applied Chemistry.* Chennai: MJP, 2006.

David, A. Williams, Thomas L. Lemke. *Foye's Principles of Medicinal Chemistry*.USA: Lippincott Williams & Wilkins, 2005.

Graham, Patrick. *An Introduction to Medicinal Chemistry***.** Oxford : Oxford University Press, 2001.

John, H. Block, John M. Beale, Jr. *Organic Medicinal and Pharmaceutical Chemistry***.** USA: Lippincott Williams & Wilkins, 2004.

Sujatha, V. Bhat. *Biomaterials*.Chennai :Narosa, 2005.

JOURNALS
Journal of Drug Issues
Journal of Medicinal Chemistry
Journal of Medicinal Chemistry Research

WEB RESOURCES
http://chem2.sis.nlm.nih.gov/chemidplus/chemidlite.jsp

PATTERN OF ASSESSMENT

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Section C – 1 x 15 = 15 Marks (1 out of 2 to be answered)

Other Components: Total Marks: 50
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End-Semester Examination: Total Marks: 100 Duration: 3 hours
Section A – 20 x 1 = 20 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match and answer in a line or two)
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M.Sc. DEGREE: BRANCH IV - CHEMISTRY

SYLLABUS
(Effective from the academic year 2019-2020)

INTRODUCTION TO FORENSIC CHEMISTRY

CODE:19CH/PI/IF24 **CREDITS:4**

OBJECTIVES OF THE COURSE

- To equip the students with the knowledge of forensic science
- To give an insight into diagnostic testing and to encourage the students to work and pursue research in Forensic Science.

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- Recall the history and importance of Forensic science
- Compare the different types of physical evidence used in tracking
- Discuss the importance of toxicology and analytical techniques for detection
- Identify fire hazards and use of explosives in the affected area

Unit 1

Forensic Science

1.1 Brief History of Forensic Science, Function of Forensic Science in the Laboratory
1.2 Processing the Scene of Crime and Forensic Photography

Unit 2

Physical Evidence (Tracks and trails)

2.1 Physical Evidence –Classification. Significance of fingerprints and palm prints, footprints, Shoe and Tyre Impression
2.2 Trace Evidence-Soil, Glass, Paint
2.3 Biological Material-Blood, Hair, Bones, Teeth-Application of DNA Profiling

Unit 3

Toxicology and Analysis Techniques

3.1 Radioactive Decay Reactions and Neutron Activation Analysis
3.2 Atomic Absorption Spectroscopy and X-Ray Analysis to detect Samples
3.3 Poisons-Classification. Symptoms and Antidotes for some common Poisons

Unit 4

Tracking Forgery

4.1 Disputed Documents-Types-Document Examination. Use of UV Rays in Detection of Counterfeit Currency and Stamp Paper
4.2 Identification of Forgery in Hand Written and Typed Document
4.3 Paper Chromatography of ink

Unit 5

Fire-Arson and Explosives

5.1 Characteristics of Accidental Fires

5.2 Arson-Evidence from Fire affected area to detect the cause of the Fire

5.3 Explosive-Classification-Evidence from the scene of explosion to detect the cause of explosion

BOOKS FOR STUDY

Vapuly, A .K. *Forensic Science its Approach in Crime Investigation.* Hyderabad: Paras, 2006.

Sharma, B.R. *Forensic Science in Criminal Investigation and Trials*. New Delhi: Universal, 2006.

BOOKS FOR REFERENCE

Russel, Max, M.Houck, Jay A Siegel.*Fundamentals of Forensic Science*. Amsterdam: Elsevier, 2006.

Henry, C. Lee,Timothy Palmbach, Marilyn C.Miller.*Henry Lee's Crime Scene Hand book.* Amsterdam: Elsevier, 2001.

JOURNALS

Journal of Forensic Science
Journal of Forensic Research
Forensic Science Communication
Journal of Forensic Psychology

WEB RESOURCES

http://www.all-about-forensic-science.com/
http://dci.sd.gov/ForensicLab/ForensicWebsites.aspx

PATTERN OF ASSESSMENT

End-Semester Examination: Total Marks: 100 Duration: 3 Hours

Section A – 20 x 1 = 20 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match the following and answer in a line or two)
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M.Sc. DEGREE: BRANCH IV - CHEMISTRY

SYLLABUS

(Effective from the academic year 2019-2020)

CHEMISTRY OF NATURAL PRODUCTS

CODE:19CH/PI/NP24 **CREDITS:4**

OBJECTIVES OF THE COURSE

- To understand the origin and classification of natural products
- To appreciate the chemical structure of physiological functions of natural products and their derivatives
- To think critically about the use of herbal remedies and the potential of drug development from natural products

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- Demonstrate knowledge on the methods of preparation, properties and structures of amino acids, polypeptides and proteins
- Recognize the structures of steroids and their biological role
- Elucidate the structures of simple alkaloids and terpenoids
- Distinguish between important types of natural pigments based on their colour, absorption and chemical properties

Unit 1

Amino Acids, Peptides and Proteins

1.1 Introduction to Amino Acids
1.2 General Methods of Preparation and Properties of Amino Acids
1.3 Naturally Occurring Peptides and Nomenclature of Poly Peptides
1.4 General Principle of Polypeptide Synthesis
1.5 Representation of Polypeptides. Determination of Structure of Peptides
1.6 Classification of Proteins. Primary , Secondary and Tertiary Structure of Proteins

Unit 2

Steroids

2.1 Nomenclature and Stereochemistry (Configuration of Substituent, Ring and Side Chain)
2.2 Classification of Sterols and Related Colour Reactions
2.3 Cholesterol- Occurrence, Isolation, Clinical Significance, Structure Elucidation and Total Synthesis
2.4 Steroid Hormones- Synthesis of Estrogen and Progesterone

Unit 3

Terpenoids

Source and Extraction
3.1 Classification and Isolation

3.2 General Methods of Structure Determination of Terpenoids
3.3 Structure Elucidation of Carvone-D, Longifolene, Abetic Acid and β-Carotene

Unit 4

Alkaloids

4.1 Occurrence and Functions
4.2 Classification and Nomenclature
4.3 General Methods of Structure Determination and Pharmaceutical Applications
4.4 Structure Elucidation of Conine, Nicotine and Caffeine

Unit 5

Plant Pigments

5.1 Representation of Flavonoids, Flavones, Flavonols and Isoflavones
5.2 Glycosides of Flavones and Flavonols
5.3 General Methods of Structure Determination of Flavonoids
5.4 Structure Elucidation of Apigenin and Quercetin
5.5 Anthocyanidins and Anthocyanins - General Methods of Structure Determination
5.6 Structure Elucidation of Cyanidin and Hirsutidin
5.7 Structural Relationship between Flavonols (Quercetin), Anthocyanidin (Cyanidin) and Catechins (Epicatechin)

BOOKS FOR STUDY

Bhat, S.V., B.A.Nagasampagi, M.Siva Kumar. *Chemistry of Natural Products.*New Delhi :Narosa, 2006.
Ahluwalia, V.K., Sanjiv Kumar, Lalita S. Kumar. *Chemistry of Natural Products.* New Delhi :CRC Press, 2007.

BOOKS FOR REFERENCE

Stanforth ,P.Stephen. *Natural Product Chemistry at a Glance*, Hoboken:Wiley Blackwell, 2006.

JOURNALS

Journal of Natural Products
Natural Product Research
Journal of Asian Natural Products
Indian Journal of Natural Products and Resources

WEB RESOURCES

https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/biomol.htm
http://dnp.chemnetbase.com/intro/

PATTERN OF ASSESSMENT

End-Semester Examination: Total Marks: 100 Duration: 3 Hours

Section A – 20 x 1 = 20 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match the following and answer in a line or two)
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M.Sc. DEGREE: BRANCH IV- CHEMISTRY

SYLLABUS

(Effective from the academic year 2019–2020)

ANALYTICAL INSTRUMENTATION

CODE:19CH/PE/AI15 **CREDITS:5**

L T P:5 0 0

TOTAL TEACHING HOURS:65

OBJECTIVES OF THE COURSE

- To equip the students with knowledge about different analytical techniques with a focus on their applications in industries and research laboratories
- To give an insight on the fundamental principles of analytical instrumentation techniques in order to pursue research

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- Relate the theoretical principles of various spectroscopic techniques to their applications
- Illustrate the importance of various surface characterisation techniques
- Recall the principles, instrumentation and applications of important electrochemical techniques
- Apply the principles of thermoanalytical techniques to study organic and inorganic compounds
- Separate simple organic mixtures using different chromatographic techniques

Unit 1 **(15 Hours)**

Spectroscopic Techniques

1.1 UV-Visible Spectroscopy- Principle and Instrumentation of Double Beam Spectrophotometer, Spectropolarimeter (Optical Rotatory Dispersion) and Spectrophotometer (Circular Dichroism)

1.2 Atomic Absorption and Emission Spectroscopy- Introduction, Principle and Instrumentation

1.3 Inductively Coupled Plasma Atomic Emission Spectroscopy (ICPAES) - Principle, Instrumentation and Applications

1.4 Infrared Spectroscopy- Dispersive and Fourier Transform- Principle and Instrumentation

1.5 Raman Spectroscopy- Principle and Instrumentation, Theory of Resonance Raman and Surface enhanced Raman Techniques

Unit 2 **(15 Hours)**

Surface Characterisation Techniques

Principle, Instrumentation and Applications of -

2.1 Photoelectron Spectroscopy – Ultraviolet and X-Ray Photoelectron Spectroscopy (UPS and XPS), Auger Electron Spectroscopy (AES).

2.2 Electron Microscopy: Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM)

2.3 Probing Microscopy: Scanning Tunnelling Microscopy (STM), Atomic Force Microscopy (AFM)
2.4 Low Energy Electron Diffraction

Unit 3 **(15 Hours)**

Electrochemical Techniques

Principle, Instrumentation and Applications of -

3.1 Polarography (DC, AC and Pulse), Anodic and Cathodic Stripping Voltammetry.
3.2 Coulometry: Current- Voltage Relationship during Electrolysis, Coulometric Methods of Analysis, Potentiostatic Coulometry, Coulometric Titrations (Amperostatic Coulometry)
3.3 Amperometry, Amperometric Titrations, Biamperometry
3.4 Chronomethods: Chronoamperometry, Chronopotentiometry and Chronocoulometry
3.5 Cyclic Voltammetry

Unit 4 **(14 Hours)**

Thermoanalytical and Radiochemical Techniques

4.1 Thermogravimetry (TG), Differential Thermal Analysis. Differential Scanning Calorimetry - Principle, Instrumentation, Factors affecting Thermogram and Applications, Evolved Gas Analysis
4.2 Thermometric Titrations – Principle, Working and Applications
4.3 Radiochemical Methods: Hot Atom Chemistry – the Szilard - Chalmers Process, Neutron Activation Analysis - Principle, Instrumentation and Applications

Unit 5 **(6 Hours)**

Chromatography

5.1 Chromatography - Liquid Chromatography – Principles of Thin Layer and Column Chromatography.
5.2 High Performance Liquid Chromatography (HPLC) - Principle, Instrumentation, Advantages and Applications.
5.3 Gas Chromatography (GC) – Principle and Instrumentation, GC-Mass Spectrometry – Applications

BOOKS FOR STUDY

Douglas, A. Skoog, James F.Holler and Niemen. *Principles of Instrumental Analysis*. Singapore: Haracourt Asia, 2001.
Sharma, B.K. *Instrumental Methods of Chemical Analysis*.Meerut: Goel, 2004.

BOOKS FOR REFERENCE

Anjaneyulu, Y., Chandrasekhar.K and Valli Manickam. *A Text Book of Analytical Chemistry*. India: Pharma Book Syndicate, 2006.
Brown, R.D. *Introduction to Instrumental Analysis*. Singapore: McGraw Hill, 1987.
Eland**,** J.H.D. *Photoelectron Spectra*. London :Butterworths, 1984.
Douglas A.Skoog, Donald M West and James F Holler, Stanley R. Crouch. *Fundamentals of Analytical Chemistry*. New York :Saunders, 2004.
Ewing, W.Galen. *Instrumental Methods of Chemical Analysis*. New York: McGraw Hill,1985.
Bard, A.J and L.R.Faulkner. *Electrochemical Methods- Fundamentals and Applications.* New York:Wiley, 2006.

Fifield, F.W. and Kealy D. *Principles and Practice of Analytical Chemistry*. USA: Blackwell Science, 2004.
Gary D.Christian and James E. O'Reilly. *Analytical Chemistry*. New York :John Wiley, 2004.

JOURNALS
Journal of Analytical Chemistry
Journal of Spectroscopy
Journal of Electrochemistry

WEB RESOURCES
www.annualreviews.org/doi/abs/10.1146/annurev.pc.06.100155.001041

PATTERN OF ASSESSMENT
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M.Sc. DEGREE: BRANCH IV- CHEMISTRY

SYLLABUS

(Effective from the academic year 2019–2020)

ESSENTIALS OF BIOCHEMISTRY

CODE:19CH/PE/BC15 **CREDITS:5**

L T P:5 0 0

TOTAL TEACHING HOURS:65

OBJECTIVES OF THE COURSE

- To enable the understanding of the structure-function relationship of biomolecules
- To give an insight into the metabolic pathways and the consequences of deviation from normal
- To instill interest in research in Biochemistry

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- Understand the importance of biochemical processes and the role of water as a biological solvent
- Apply bioenergetics to biological systems
- Distinguish between the structure of biomolecules like proteins and nucleic acids
- Determine the role of biomolecules and catalysts in biological processes

Unit 1 **(12 Hours)**

Introduction to Biochemistry

1.1 Scope of Biochemistry, Relationship between Biochemistry and Medicine; Normal Biochemical Process – Basis of Health

1.2 Water as a Biological Solvent and its Importance in Maintaining the Structure of Biomolecules

1.3 Acid Base Balance, Biological Buffers - Bicarbonate, Phosphate, Protein and Haemoglobin - Acidosis and Alkalosis

Unit 2 **(12 Hours)**

Bioenergetics

2.1 Bioenergetics: Conventions in Biochemical Energetics

2.2 ATP as the Universal Currency for Free Energy in Biological Systems

2.3 Free Energy of Hydrolysis of ATP and other Organophosphates

2.4 Structural Basis for the High Group Transfer Potential of ATP

2.5 Standard Free Energy Changes for Representative Chemical Reactions

2.6 Inter-Conversion of Adenine Nucleotides

Unit 3 **(16 Hours)**

Biomolecules

3.1 Biomolecules: Elementary Structure of Proteins, Nucleic Acids and Membrane Bilipids (Fluid Mosaic Structure)

3.2 Relationship between the Structure and Function of Proteins and the Consequences of Deviation from Normal

Unit 4 **(12 Hours)**

Biocatalysts – Enzymes

4.1 Enzymes, Definition, Co-Factor, Apoenzyme
4.2 General Properties, Active Site, Factors affecting Enzyme Action
4.3 Enzyme Regulation; Allosteric, Feedback Regulation, Product Inhibition
4.4 Immobilization of Enzymes, Methods and Applications

Unit 5 **(13 Hours)**

Metabolism

5.1 Definition, Terminology and Functions of Metabolism
5.2 Metabolism of Carbohydrates – Glycolysis, Gluconeogenesis, Glycogen Metabolism, and TCA Cycle
5.3 Proteins – Oxidative Deamination, Transamination and Urea Cycle
5.4 Lipids – Beta Oxidation of Fatty Acids and Biosynthesis of Fatty Acids, Triglycerides and Cholesterol
5.5 Xenobiotics - General Methods of Detoxification

BOOKS FOR STUDY

Albert, Lehninger. *Biochemistry.*New York :Worth , 2008.
Jain, J.L. *Fundamentals of Biochemistry***.**New Delhi: S.Chand, 2008.

BOOKS FOR REFERENCE

Brandon and Tooze. *Introduction to Protein Structure*. New York: Garland, 2000.
Conn, E.E. and Stumpf. *Biochemistry*. New York :Wiley Eastern,1976.
Glick, R. Bernard and Pasternak J. Jack. *Molecular Biotechnology-Principles and Applications of Recombinant DNA.* Washington: ASM Press, 2005.
Lubert, Stryer. *Biochemistry*. New York: W.H. Freeman, 2009.
Jain, J.L. *Fundamentals of Biochemistry***.** New Delhi : S.Chand , 2008.
Jeremy, M. Berg. *Biochemistry.*New York : W.H. Freeman, 2001.
Voet, D. and Voet. G. *Biochemistry***.** New York: John Wiley, 2007.

JOURNALS

Journal of Biochemistry
Journal of Clinical Biochemistry
Nature

WEB RESOURCES

http://www.csun.edu/~hcchm001/biosites.htm
http://themedicalbiochemistrypage.org/

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90 minutes

Section A – 11 x 1 = 11 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match and answer in a line or two)
Section B – 3 x 8 = 24 Marks (3 out of 4 to be answered)
Section C – 1 x 15 = 15 Marks (1 out of 2 to be answered)

Other Components: Total Marks: 50

Quiz/Problem Solving/Seminars/Assignments

End-Semester Examination: **Total Marks: 100** **Duration: 3 hours**

Section A – 20 x 1 = 20 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match and answer in a line or two)

Section B – 5 x 8 = 40 Marks (5 out of 7 to be answered)

Section C – 2 x 20 = 40 Marks (2 out of 3 to be answered)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600086

M.Sc. DEGREE: BRANCH IV- CHEMISTRY

SYLLABUS

(Effective from the academic year 2019 – 2020)

CORROSION AND ITS PREVENTION

CODE: 19CH/PE/CP15 **CREDITS: 5**

L T P: 5 0 0

TOTAL TEACHING HOURS: 65

OBJECTIVES OF THE COURSE

- To enable understanding of the basic principles of Electrochemistry
- To describe the various types of corrosion and the theories involved
- To facilitate understanding of electrode kinetics and polarisation studies as applied to corrosion
- To give an overview of the various methods of corrosion control and testing

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- Demonstrate understanding of the principles of Electrochemistry
- Describe the different types of corrosion and their consequences
- Identify the phenomena of polarisation and electrode kinetics and apply them to corrosion studies
- Compare the different methods of corrosion control based on the factors influencing them
- Identify the different testing methods that are relevant for corrosion studies

Unit 1 (16 Hours)

Principles of Electrochemistry

1.1 Electrochemistry – Basic principles – Electrode potential, Helmholtz electrical double layer, Electrochemical cell – Half reactions, Galvanic cell, calculation of the EMF of a cell

1.2 Electrochemical cell representation- EMF Series and its significance. Relation between EMF and Free energy – Determination of EMF of a half cell - Nernst equation and its derivation.

1.3 Calculation of half-cell and cell potential – calculation of equilibrium constant for the cell reaction

1.4 Reference electrodes – Saturated calomel electrode, Glass electrode, standard hydrogen electrode.

1.5 Overvoltage or overpotential – Concentration cell and EMF of concentration cell

Unit 2 **(12 Hours)**

Principles and Types of Corrosion

2.1 Introduction – Corrosion Rate Expression – Types of Corrosion – Chemical Corrosion, Electrochemical Corrosion.

2.2 Types of Electrochemical Corrosion – Galvanic Corrosion, Concentration Cell Corrosion, Pitting Corrosion, Stress Corrosion, Inter-granular Corrosion.

2.3 Passivity, Factors influencing corrosion, EMF and Galvanic series.

2.4 Microbially influenced corrosion (MIC) – Electrochemical aspects and general mechanisms.

Unit 3 **(15 Hours)**

Electrode Kinetics and Polarisation Phenomena

3.1 Electrode – Solution Interface – definition and types of Polarisation. Exchange current density – Polarisation relationships

3.2 Polarisation Techniques – Corrosion Rate Determination. Mixed potentials – concepts and basics.

3.3 Mixed Potential Theory – bimetallic couples, activation and diffusion controlled processes

Unit 4 **(12 Hours)**

Methods of Corrosion Control

4.1 Protection against corrosion – Material selection and Proper Designing Principles, inhibitors and surface engineering

4.2 Cathodic Protection – Principles and Classification – Sacrificial Anodic Protection and Impressed Current Cathodic Protection. Stray Current Corrosion. Anodic Protection

4.3 Passivity – Definition and parameters influencing passivity, design of Corrosion Resistant Alloys

4.4 Coatings – Metallic Coatings – Organic and Polymer Coatings – Phosphating

Unit 5 **(10 Hours)**

Corrosion Testing

5.1 NACE test methods – Open-circuit Potential – Time measurements – Cyclic polarization – Tafel plot for aluminium alloys

5.2 Linear polarisation – Potentiostatic steady state experiments – Small Amplitude Cyclic Voltammetry (SACV)

5.3 AC impedance methods – Slow strain rate test.

BOOKS FOR STUDY

J. O. M.Bockris and A.K. N Reddy, *Modern Electrochemistry. Vol. I and II*, New York: Plenum Press, 1970.

Jain P.C. and Monika Jain, *Engineering Chemistry*, New Delhi, Dhanpat Rai Publishing Company Pvt. Ltd. 2011.

BOOKS FOR REFERENCE

Denny A Jones, *Principles and Prevention of Corrosion*, New Jersey, Prentice Hall, 1996.

H. H. Uhlig and R. W. Revie, *Corrosion and Corrosion Control*, New York, Wiley, 1985.

M. G. Fontana, *Corrosion Engineering*, New York, McGraw-Hill Book Company, 1987.

B. J. Little, *Microbiologically Influenced corrosion*, New York, Wiley-Interscience, 2007.

JOURNALS
Corrosion Science
Materials and Corrosion
Corrosion Reviews

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90 minutes
Section A – 11 x 1 = 11 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match and answer in a line or two)
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Section C – 1 x 15 = 15 Marks (1 out of 2 to be answered)

Other Components: Total Marks: 50
Quiz/Problem Solving/Seminars/Assignments

End-Semester Examination: Total Marks: 100 Duration: 3 Hours
Section A – 20 x 1 = 20 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match and answer in a line or two)
Section B – 5 x 8 = 40 Marks (5 out of 7 to be answered)
Section C – 2 x 20 = 40 Marks (2 out of 3 to be answered)

STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600086

M.Sc. DEGREE: BRANCH IV- CHEMISTRY

SYLLABUS

(Effective from the academic year 2019–2020)

INDUSTRIAL WASTE MANAGEMENT

CODE:19CH/PE/IM15 **CREDITS:5**

L T P:5 0 0

TOTAL TEACHING HOURS:65

OBJECTIVES OF THE COURSE

- To provide students with an understanding of the present environmental scenario and educate them on the causes and consequences of environmental degradation
- To create an understanding of the nature of industrial wastes
- To work towards effective and efficient management of industrial wastes
- To give an overview of Environmental Management, Environmental Impact Assessment and Pollution Control measures for working towards Green Earth

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- Explain the causes of pollution and characteristics of pollutants
- Outline the methods of pollution control and waste management
- Discuss the steps towards sustainable development
- Describe the salient features of regulatory acts in India and efforts taken at national and global levels pertaining to environmental protection

Unit 1 **(12 Hours)**

Air Pollution Control

1.1 Air Quality Standards (for varied industries), Industrial safety, Classification of Air Pollutants, Sources of Air Pollution, Ozone Depletion, Green House Effect – Causes and Consequences

1.2 Pollution Control of Particulates – Gravity Settling Chamber, Cyclone Collector, Filters, Wet Scrubbers, Electrostatic Filters, Electrostatic Precipitator

1.3 Control of CO, Oxides of Nitrogen, Oxides of Sulphur, Hydrocarbons, Photochemical Pollutants, Green House Gases

Unit 2 **(15 Hours)**

Treatment and Disposal of Industrial Effluents

2.1 Water Quality Standards, Sources of Water Pollution, Characterisation of Waste Water by Physical and Chemical methods

2.2 Primary Treatment: Sedimentation, Neutralization, Coagulation, Equalization, Grid Removal. Secondary Treatment: Aerobic Treatment, Oxidation Ponds, Oxidation Ditches, Trickling Filters, Activated Sludge Process, Aerated Lagoons, Anaerobic Treatment. Tertiary Treatment: Reverse Osmosis, Electrodialysis, Desalination

2.3 Industrial Effluents: Characteristics and Treatment Options for Effluents from various Industries: Textiles and Dyes, Paper and Pulp, Leather, Food and Dairy, Fertilizers, Electroplating Industries, Distilleries

2.4 Sewage Treatment
2.5 Water Conservation, Recycling of Waste Water and Rain Water Harvesting

Unit 3 **(12 Hours)**

Solid Waste Management

3.1 Solid Wastes- Types, Characteristics
3.2 Solid Waste Disposal – Sanitary Landfills, Vermi Composting, Incineration
3.3 Waste Minimization and Recycling

Unit 4 **(10 Hours)**

Environmental Toxicology

4.1 Toxicity, Threshold Limiting Value of Pollutants, LD_{50}
4.2 Toxic Effects of Pb, As, Cd, Hg, PCBs, Pesticides, Heavy Metals, Nanoparticles
4.3 Case Studies: Bhopal Gas Tragedy, Chernobyl Accident, Love Canal Episode, Minamata Disease, Itai-Itai Disease

Unit 5 **(16 Hours)**

Environmental Management

5.1 Sustainable Development: Definition, Sustainability Cycle, Biodiversity, Problems of Urbanization and Steps towards Sustainable Development
5.2 Environmental Impact Assessment: Concept, Environmental Risk Assessment, Legal and Regulatory Aspects in India- Environmental (Protection) Act 1986, Air (Prevention and Control of Pollution) Act 1981, Water (Prevention and Control of Pollution) Act 1981, ISO 14000, Tsunami Disaster
5.3 Industrial Safety and Health: EPA, OSHA – Regulations, Polluter Pays Principle
5.4 Global and National Efforts: Steps taken towards Green Future at the National and Global Level
5.5 Coastal Management (National Standards)

BOOKS FOR STUDY

Sharma B.K. and Kaur H. *Environmental Chemistry*, Meerut: Goel, 2014.
Gaur G. *Soil and Solid Waste Pollution and its Management*, New Delhi: Sarup, 2000.

BOOKS FOR REFERENCE

Dara, S.S. *A Text Book of Environment Chemistry and Pollution Control***,** New Delhi: S.Chand, 2004.
Leelakrishnan, *Environmental laws in India*, New Delhi: Butterworths, 2002.
Mohan I. *Environmental Pollution and Management*, New Delhi: Ashish,1990.
NIIR Board, *Modern Technology of Waste Management- Pollution Control, Recycling, Treatment and Utilization*.New Delhi: Asia Pacific Business, 2003.
Paul L. Bishop, *Pollution Prevention - Fundamentals and Practices*.NewYork : McGraw Hill, 2000.
Trivedy R.K. and Raman N.S. *Industrial Pollution and Environmental Management*. Jodhpur :Scientific, 2003.
Willen Rudolf, *Industrial Wastes Their Disposal and Treatment*. Bikaneer: Allied Sci entific, 1997.

JOURNALS

Energy and Environmental Science
Environmental Toxicology & Chemistry
Environmental Science: An Indian Journal
Journal of Pollution Research
Journal of Environmental Chemistry

WEB RESOURCES

http://environmentalchemistry.com/
http://www.niehs.nih.gov/health/topics/agents/

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90 minutes

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Other Components: Total Marks: 50

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End-Semester Examination: Total Marks: 100 Duration: 3 hours

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STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600086

M.Sc. DEGREE: BRANCH IV- CHEMISTRY

SYLLABUS

(Effective from the academic year 2019–2020)

NANOCHEMISTRY

CODE:19CH/PE/NC15 **CREDITS:5**

L T P:5 0 0

TOTAL TEACHING HOURS:65

OBJECTIVES OF THE COURSE

- To study the top-down and bottom-up approaches to Nanochemistry
- To describe methods by which nanoscale manufacturing can be enabled
- To discuss the concept and context of nanotechnology within society

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- Explain the fundamental principles of nanoscience
- Describe the methods used to synthesize and fabricate nanomaterials
- Identify accurate characterisation techniques for different kinds of nanomaterials
- Discuss current applications of nanophase materials

Unit 1 **(12 Hours)**

Introduction to Nanoscience

1.1 Concepts of Nanoscience and Nanotechnology, Nanosized effects, Surface to Volume ratio, Quantum structures, Quantum confinement effects

1.2 Classification of Nanosystems based on origin (natural and artificial), dimensionality and structural configuration (Carbon based, Metal based, Dendrimers, Composites)

1.3 Special nanomaterials: Carbon Nanotubes, Fullerenes, Graphene and Self Assembled monolayers (SAMs), Nanoclusters

1.4 Applications of Nanomaterials in electronics, Nanomechanics and nanobots, catalysis (gold nanoparticles), Quantum dot devices, Medicine and Drug delivery

1.5 Nanowires and Nanomachines

Unit 2 **(15 Hours)**

Fabrication of Nanomaterials

2.1 Techniques for Synthesis of Nanophase Materials – Top-down vs Bottom-up approach

2.2 Physical Methods of Synthesis-High energy Ball milling, Arc discharge, Plasma synthesis, Aerosol synthesis, Physical and Chemical Vapour deposition, Electrodeposition

2.3 Chemical Methods of Synthesis–Chemical reduction , Solvothermal, Hydrothermal, Microemulsion, Sol gel method

2.4 Synthesis and applications of Pure Metal nanoparticles (Gold and Silver) and

metal oxide nanoparticles (ZnO, TiO_2)

2.5 Nanomaterial fabrication techniques- Lithography, Electrospinning

Unit 3 **(15 Hours)**

Nanocomposites

3.1 Definition of composite materials: Classification based on matrix and reinforcements, Properties and Processing of nanocomposites

3.2 Types of nanocomposites: polymer-clay nanocomposites, conducting nanocomposites, types of nanofiller- metal oxides, layered silicates, nanowires, nanotubes and quantum dots.

3.3 Characterisation of nanocomposites: thermal, mechanical, surface, physical properties-density, viscosity, spectral analysis

3.4 Application of nanocomposites

Unit 4 **(18 Hours)**

Properties and Characterisation Techniques of Nanophase Materials

4.1 Size Dependent properties of Nanomaterials: Optical properties (Surface Plasmon resonance), mechanical, electrical, magnetic and thermal properties. Kinetic and Thermodynamic Features of Nano materials

4.2 Characterisation techniques* (with reference to nanomaterials): UV-Visible Spectroscopy-Band Gap calculation, X ray diffraction, Wide angle extended X-ray absorption technique, Electron Microscopy – SEM/TEM, DLS, Defects in Nanomaterials, Co-relation of XRD and TEM

4.3 Electron Spectroscopy – XPS/UPS, AES, Scanning Probe Microscopes - AFM, STM.

*No instrumentation required

Unit 5 **(5 Hours)**

Impacts of Nanomaterials

5.1 Nanomaterials and the Environment – Exposure, Fate, Transport and Transformation

5.2 Nanomaterials and Biological systems – Toxicity, Exposure and Absorption, Metabolism

BOOKS FOR STUDY

Guozhong C. *Nanostructures & Nanomaterials: Synthesis, Properties & Applications*, London: Imperial College Press,2004

Ramachandra R., Singh S, *Nanoscience and Nanotechnology-Fundamentals and Frontiers*. New Delhi , Wiley,2013

BOOKS FOR REFERENCE

Atkins, Peter, T.Overton, J.Rourke, M.Weller and F.Armstrong, *Shriver and Atkins' Inorganic Chemistry*.Chennai: Oxford University Press, 2006.

Brechigneae,C.,P.Houdy, M.Lahmai.*Nanomaterials and Nanochemistry*.Berlin: Springer, 2007.

Kenneth, J.Klabunde. *Nanoscale Materials in Chemistry*.New York: John Wiley, 2001.

Poole,C.P.and F.J.Owens.*Introduction to Nanotechnology*.Hoboken:Wiley-Interscience, 2003.

Ratner, M. and D.Ratner.*Nanotechnology- The Next Big Idea*. New York: Prentice Hall, 2003.

Steed,J. W., D. R.Turner, K.Wallace.*Core Concepts in Supramolecular Chemistry and*

Nanochemistry. New York:Wiley, 2007.
Thomas S, Thomas S, Zachariah A. K (edited by) *Thermal and Rheological Measurement Techniques for Nanomaterials Characterisation* . Cambridge: Elsevier,2017
Grassian V.H., *Nanoscience and Nanotechnology-Environmental and Health Impacts*, New York :Wiley, 2008
Pradeep,T.*Nano: The Essentials - Understanding Nanoscience and Nanotechnology*.NewDelhi:Tata McGraw Hill, 2007.

JOURNALS

Nanoletters
Journal of composite Materials
Surface science
ACS Nano
Nature Nanotechnology
Advanced Materials
Nanoscale
Nanotechnology

WEB RESOURCES

http://sphinxsai.com/vol3.no2/chem/chempdf/CT=03(534-538)AJ11.pdf
http://www.ijsce.org/attachments/File/Vol-1_Issue-6/F0342121611.pdf

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90 minutes

Section A – 11 x 1 = 11 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match and answer in a line or two)
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STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600086

M.Sc. DEGREE: BRANCH IV- CHEMISTRY

SYLLABUS

(Effective from the academic year 2019–2020)

NANOCHEMISTRY

CODE:19CH/PE/NC15 **CREDITS:5**

L T P:5 0 0

TOTAL TEACHING HOURS:65

OBJECTIVES OF THE COURSE

- To study the top-down and bottom-up approaches to Nanochemistry
- To describe methods by which nanoscale manufacturing can be enabled
- To discuss the concept and context of nanotechnology within society

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- Explain the fundamental principles of nanoscience
- Describe the methods used to synthesize and fabricate nanomaterials
- Identify accurate characterisation techniques for different kinds of nanomaterials
- Discuss current applications of nanophase materials

Unit 1 **(12 Hours)**

Introduction to Nanoscience

1.6 Concepts of Nanoscience and Nanotechnology, Nanosized effects, Surface to Volume ratio, Quantum structures, Quantum confinement effects

1.7 Classification of Nanosystems based on origin (natural and artificial), dimensionality and structural configuration (Carbon based, Metal based, Dendrimers, Composites)

1.8 Special nanomaterials: Carbon Nanotubes, Fullerenes, Graphene and Self Assembled monolayers (SAMs), Nanoclusters

1.9 Applications of Nanomaterials in electronics, Nanomechanics and nanobots, catalysis (gold nanoparticles), Quantum dot devices, Medicine and Drug delivery

1.10 Nanowires and Nanomachines

Unit 2 **(15 Hours)**

Fabrication of Nanomaterials

2.6 Techniques for Synthesis of Nanophase Materials – Top-down vs Bottom-up approach

2.7 Physical Methods of Synthesis-High energy Ball milling, Arc discharge, Plasma synthesis, Aerosol synthesis, Physical and Chemical Vapour deposition, Electrodeposition

2.8 Chemical Methods of Synthesis–Chemical reduction , Solvothermal, Hydrothermal, Microemulsion, Sol gel method

2.9 Synthesis and applications of Pure Metal nanoparticles (Gold and Silver) and metal oxide nanoparticles (ZnO, TiO_2)

2.10 Nanomaterial fabrication techniques- Lithography, Electrospinning

Unit 3 **(15 Hours)**

Nanocomposites

3.5 Definition of composite materials: Classification based on matrix and reinforcements, Properties and Processing of nanocomposites

3.6 Types of nanocomposites: polymer-clay nanocomposites, conducting nanocomposites, types of nanofiller- metal oxides, layered silicates, nanowires, nanotubes and quantum dots.

3.7 Characterisation of nanocomposites: thermal, mechanical, surface, physical properties-density, viscosity, spectral analysis

3.8 Application of nanocomposites

Unit 4 **(18 Hours)**

Properties and Characterisation Techniques of Nanophase Materials

4.4 Size Dependent properties of Nanomaterials: Optical properties (Surface Plasmon resonance), mechanical, electrical, magnetic and thermal properties. Kinetic and Thermodynamic Features of Nano materials

4.5 Characterisation techniques* (with reference to nanomaterials): UV-Visible Spectroscopy-Band Gap calculation, X ray diffraction, Wide angle extended X-ray absorption technique, Electron Microscopy – SEM/TEM, DLS, Defects in Nanomaterials, Co-relation of XRD and TEM

4.6 Electron Spectroscopy – XPS/UPS, AES, Scanning Probe Microscopes - AFM, STM.

*No instrumentation required

Unit 5 **(5 Hours)**

Impacts of Nanomaterials

5.3 Nanomaterials and the Environment – Exposure, Fate, Transport and Transformation

5.4 Nanomaterials and Biological systems – Toxicity, Exposure and Absorption, Metabolism

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Brechigneae,C.,P.Houdy, M.Lahmai.*Nanomaterials and Nanochemistry*.Berlin: Springer, 2007.

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Steed,J. W., D. R.Turner, K.Wallace.*Core Concepts in Supramolecular Chemistry and Nanochemistry*. New York:Wiley, 2007.
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JOURNALS

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Nanoscale
Nanotechnology

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PATTERN OF ASSESSMENT

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STELLA MARIS COLLEGE (AUTONOMOUS), CHENNAI - 600 086

M.Sc. DEGREE: BRANCH IV – CHEMISTRY

SYLLABUS

(Effective from the academic year 2019-2020)

POLYMER MATERIALS AND APPLICATIONS

CODE:19CH/PE/PM15 **CREDITS:5**

L T P:5 0 0

TOTAL TEACHING HOURS:65

OBJECTIVES OF THE COURSE

- To introduce the students to polymer science
- To bring about an understanding of the science underlying the synthesis and processing of polymers
- To provide awareness of modern instrumental techniques that can be used to analyse the structure and behaviour of polymeric materials.

COURSE LEARNING OUTCOMES

On successful completion of the course, students will be able to

- Classify polymers based their properties
- Characterise polymers based on various analytical techniques
- Recall the different types of polymerisation techniques and fabrication
- Pursue research in this area or prepare for a career in polymer based industries

Unit 1 (18 Hours)

Introduction to Polymer Materials

1.1 Polymer Chain Structure and Configuration: Nomenclature, Functionality, Method of Linking

1.2 Classification of polymers (based on source, thermal properties and applications)

1.3 Structure, properties and applications of-Natural Polymers (starch and cellulose). Synthetic Polymers (Polyurethane, Polymethylmethacrylate, Silicone Polymers), Rubbers-Natural rubber, Synthetic rubber- (StyreneButadieneRubber and Neoprene)

1.4 Specialty Polymers-Conducting, IPN, Thermally Stable, Hydrogels, Biodegradable polymers (poly lactic acid and sodium alginate), Functional dendrimers, hyperbranched and star polymers. Structure, Properties and Applications

1.5 Types of Degradation (Thermal, Mechanical, Ultrasound, Photo, Biodegradation and Non-Biodegradation)

Unit 2 (13 Hours)

Mechanism, Kinetics of Polymerisation and Fabrication of Polymers

2.1 Types of Polymerisation – Addition, Condensation and Co Polymerisation

2.2 Mechanism - Free Radical and Ionic Polymerisation

2.3 Coordination Polymerisation with special reference to Ziegler-Natta

2.4 Kinetics of Free Radical Polymerisation

2.5 Polymerisation Techniques (Bulk, Emulsion, Solution and Suspension)
2.6 Basic Processing Operations (Extrusion, Mastication, Molding and Calendaring)
2.7 Polymer Additives - Fillers, Plasticizers, Antioxidants, Heat Stabilizers, Ultraviolet Stabilizers, Flame Retardants and Colorants

Unit 3 **(12 Hours)**

Molecular Weight Distribution of Polymers

3.1 Significance of Degree of Polymerisation and Molecular Weight of Polymers
3.2 Number Average and Weight Average Molecular Weight
3.3 Methods of Determination of Absolute Molecular Weight - Vapour Phase Osmometry, Ultracentrifugation, Light Scattering Method, GPC, Viscometry and End Group Analysis

Unit 4 **(12 Hours)**

Physical Chemistry of Polymers

4.1 Amorphous and Crystalline Polymers, Conformation of the Polymer Chain, Single Crystal Spherulites, Liquid Crystal Polymers- Terminology, Properties of Mesogens
4.2 Glass Transition Temperature- Factors Influencing Heat Distortion and Crystallisability
4.3 Thermodynamics of Polymer Solution, Flory Higgins Theory (no derivation) Phase Equilibrium, Solubility Parameter
4.4 Melt Rheology of Polymers (Polyvinylchloride, Polystyrene), Stress-Strain Properties and Visco Elastic Behaviour of Polymers, Newtonian and Non-Newtonian Behaviour of Polymers, Flow Properties of Polymer Melts and Solutions

Unit 5 **(10 Hours)**

Characterisation and Testing of Polymers

5.1 Spectroscopic Characterisation of Polymers (FTIR, NMR) (special reference to Polypropylene and Polymethylmethacrylate)
5.2 Thermal Properties, Thermal Conductivity, Thermal Expansion, TGA, DTA, DSC and DMA (special reference to Polyethyleneterephthalate and Polymethylmethacrylate)
5.3 Mechanical Properties and tests of Polymers - Hardness, Impact Strength, Stress, Relaxation, Elasticity Mechanical tests : tensile testing, flexural testing, Impact testing

BOOKS FOR STUDY

Gowariker, V.R., N.V Viswanathan, Jaydev Sreedhar.*Polymer Science*, New Delhi: New Age International, 2004.
Billmeyer, F.W.*Text Book of Polymer Science*.New York :Wiley Interscience,2006.

BOOKS FOR REFERENCE

Bhatnagar, M.S.*Text book of Polymers*.New Delhi: S.Chand, 2004.
Brandolini, J. Anita and Deborah D. Hills.*NMR Spectra of Polymers and Polymer Additives*. New York : Marcel Decker, 2000.
Flory, P.J .*Principles of Polymer Chemistry.* Ithaca: Cornell University Press,1953.
Gupta, B.R. *Applied Rheology in Polymer Processing*. New Delhi: Asian Books, 2005.
Joel ,Fried.*Polymer Science and Technology*. New Delhi: Prentice Hall, 2005.

Misra, G.S. *Introduction to Polymers*. New Delhi: New Age International, 2001.
Munk, P. *Introduction to Macro Molecular Science*. New York: John Wiley, 2002.
Stuart ,H. Barbara. *Polymer Analysis*. New Delhi: Narosa, 2002.
Young R.P., Lovell. *Introduction to Polymers*. London: Chapman & Hall, 2011.

JOURNALS

Langmuir
Macromolecules
Journal of Polymer Science

WEB RESOURCES

http://www.mpikg.mpg.de/886863/Liquid_Crystals.pdf
http://www.perkinelmer.com/CMSResources/Images/44-4546GDE_IntroductionToDMA.pdf

PATTERN OF ASSESSMENT

Continuous Assessment Test: Total Marks: 50 Duration: 90 minutes

Section A – 11 x 1 = 11 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match and answer in a line or two)
Section B – 3 x 8 = 24 Marks (3 out of 4 to be answered)
Section C – 1 x 15 = 15 Marks (1 out of 2 to be answered)

Other Components: Total Marks: 50

Quiz/Problem Solving/Seminars/Assignments

End-Semester Examination: Total Marks: 100 Duration: 3 hours

Section A – 20 x 1 = 20 Marks (All questions to be answered, questions to be of objective type: MCQ, fill in the blanks, T/F, Match and answer in a line or two)
Section B – 5 x 8 = 40 Marks (5 out of 7 to be answered)
Section C – 2 x 20 = 40 Marks (2 out of 3 to be answered)