### OPEN ELECTIVE I

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<tr>
<th>S. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT HOURS</th>
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<td>1.</td>
<td>OCY551</td>
<td>Advanced Engineering Chemistry</td>
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### OPEN ELECTIVE II

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<td>1.</td>
<td>OMF751</td>
<td>Lean Six Sigma</td>
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OBJECTIVES:

- To make the students conversant with basics of polymer chemistry
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the students with the basics of nano materials, their properties and applications.

UNIT I  POLYMERS AND SPECIALITY POLYMER  

UNIT II  ELECTROCHEMISTRY, CORROSION AND PROTECTIVE COATINGS  

UNIT III  PHOTOCHEMISTRY & ANALYTICAL TECHNIQUES  

UNIT IV  THERMODYNAMICS  
Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function- Helmholtz and Gibbs free energy functions (problems); criteria of spontaneity; Gibbs- Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van’t Hoff isotherm and isochore (problems).

UNIT V  NANOCHEMISTRY  
Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties (surface to volume ratio, melting point, optical and electrical), nanoparticles, nanocluster, nanorod, nanotube (CNT: SWNT and MWNT) and nanowire, synthesis - precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation, sol-gel process and applications (electronic and biomedical). Fullerenes: Types - $C_{60}$ - preparation, properties and applications.

TOTAL: 45 PERIODS
OUTCOMES

- The knowledge gained on polymer chemistry, thermodynamics, spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

TEXT BOOKS


REFERENCES


OIC551 BIOMEDICAL INSTRUMENTATION

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I HUMAN BODY SUBSYSTEM AND TRANSDUCERS

Brief description of muscular, cardiovascular and respiratory systems; their electrical, mechanical and chemical activities. Principles and classification of transducers for Bio-medical applications. Electrode theory, different types of electrodes; Selection criteria for transducers and electrodes.

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT


UNIT III ELECTRICAL PARAMETERS MEASUREMENT AND ELECTRICAL SAFETY


UNIT IV IMAGING MODALITIES AND BIO-TELEMETRY


UNIT V LIFE ASSISTING AND THERAPEUTIC DEVICES


TOTAL: 45 PERIODS

OUTCOMES:

1. Ability to understand communication mechanics in a biomedical system.
2. Ability to understand and analyze measurement of certain electrical and non-electrical parameters.
3. Ability to understand basic principles of imaging techniques, life assisting and therapeutic devices.

TEXT BOOKS:

REFERENCES:

OMF551 PRODUCT DESIGN AND DEVELOPMENT L T P C 3 0 0 3

OBJECTIVE:
- The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

UNIT I INTRODUCTION

UNIT II CONCEPT GENERATION AND SELECTION

UNIT III PRODUCT ARCHITECTURE

UNIT IV INDUSTRIAL DESIGN
UNIT V  DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT  

TOTAL: 45 PERIODS

OUTCOME:
• The student will be able to design some products for the given set of applications; also the knowledge gained through prototyping technology will help the student to make a prototype of a problem and hence product design and development can be achieved.

TEXT BOOK:

REFERENCES:

OCY552  FUEL CELL CHEMISTRY  L T P C  3 0 0 3

OBJECTIVES
• To create awareness about alternate clean fuel available.
• To familiarize the students with the concepts and chemistry of fuel cell

UNIT I  INTRODUCTION  9
Overview of fuel cells: Low and high temperature fuel cells; Fuel cell thermodynamics - heat, work potentials, prediction of reversible voltage, fuel cell efficiency.

UNIT II  FUEL CELL KINETICS  9
Fuel cell reaction kinetics - electrode kinetics, overvoltage, Tafel equation, charge transfer reaction, exchange currents, electro catalysis - design, activation kinetics, Fuel cell charge and mass transport - flow field, transport in electrode and electrolyte.

UNIT III  CHARACTERIZATION TECHNIQUES  9
Fuel cell characterization - in-situ and ex-situ characterization techniques, i-V curve, frequency response analysis; Fuel cell modeling and system integration: - 1D model – analytical solution and CFD models.

UNIT IV  RENEWABLE SOURCES  9
Balance of plant; Hydrogen production from renewable sources and storage; safety issues, cost expectation and life cycle analysis of fuel cells.
UNIT V  APPLICATIONS OF FUEL CELL

Fuel cell power plants: fuel processor, fuel cell power section (fuel cell stack), power conditioner; automotive applications, portable applications

OUTCOME

- Students will be aware of alternate energy sources and its importance of it.

TEXTBOOKS


REFERENCES


OMF751 LEAN SIX SIGMA

OBJECTIVE:

- To gain insights about the importance of lean manufacturing and six sigma practices.

UNIT I  LEAN & SIX SIGMA BACKGROUND AND FUNDAMENTALS

Historical Overview – Definition of quality – What is six sigma - TQM and Six sigma - lean manufacturing and six sigma- six sigma and process tolerance – Six sigma and cultural changes – six sigma capability – six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ), Cost of Doing Nothing – assessment questions

UNIT II  THE SCOPE OF TOOLS AND TECHNIQUES


UNIT III  SIX SIGMA METHODOLOGIES

Design For Six Sigma (DFSS), Design For Six Sigma Method - Failure Mode Effect Analysis (FMEA), FMEA process - Risk Priority Number (RPN)- Six Sigma and Leadership, committed leadership – Change Acceleration Process (CAP)- Developing communication plan – Stakeholder

UNIT IV  SIX SIGMA IMPLEMENTATION AND CHALLENGES

Tools for implementation – Supplier Input Process Output Customer (SIPOC) – Quality Function Deployment or House of Quality (QFD) – alternative approach –implementation – leadership training, close communication system, project selection – project management and team – champion training – customer quality index – challenges – program failure, CPQ vs six sigma, structure the deployment of six sigma – cultural challenge – customer/ internal metrics

UNIT V  EVALUATION AND CONTINUOUS IMPROVEMENT METHODS

Evaluation strategy – the economics of six sigma quality, Return on six Sigma (ROSS), ROI, poor project estimates – continuous improvement – lean manufacturing – value, customer focus,
Perfection, focus on waste, overproduction – waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people – Kaizen – 5S

OUTCOME:
- The student would be able to relate the tools and techniques of lean sigma to increase productivity

REFERENCES:
3. Fred Soleimannejed, Six Sigma, Basic Steps and Implementation, AuthorHouse, 2004

OML753 SELECTION OF MATERIALS

OBJECTIVES:
- The subject exposes students to the basics parameter for selection of materials and different classes of materials, manufacturing processes and their properties, applications of materials.

UNIT I ENGINEERING MATERIALS

UNIT II MATERIAL PROPERTIES

UNIT III MANUFACTURING PROCESSING AND ECONOMIC ANALYSIS

UNIT IV MATERIALS SELECTION CHARTS AND TESTING

UNIT V APPLICATIONS AND USES

TOTAL: 45 PERIODS

OUTCOMES:
- Understand different types of availability materials
- Easy and effective way to select required materials
• Ability to identify the material properties

TEXTBOOKS:

REFERENCES:

OME752 SUPPLY CHAIN MANAGEMENT

OBJECTIVE:
• To provide an insight on the fundamentals of supply chain networks, tools and techniques.

UNIT I INTRODUCTION
Role of Logistics and Supply chain Management: Scope and Importance- Evolution of Supply Chain - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles.

UNIT II SUPPLY CHAIN NETWORK DESIGN

UNIT III LOGISTICS IN SUPPLY CHAIN

UNIT IV SOURCING AND COORDINATION IN SUPPLY CHAIN
Role of sourcing supply chain supplier selection assessment and contracts- Design collaboration -sourcing planning and analysis - supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

UNIT V SUPPLY CHAIN AND INFORMATION TECHNOLOGY
The role IT in supply chain- The supply chain IT frame work Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain.

OUTCOME:
• The student would understand the framework and scope of supply chain networks and functions.

TEXTBOOK:

REFERENCES:

OME751 DESIGN OF EXPERIMENTS

OBJECTIVE:
- To impart knowledge on various types of experimental designs conduct of experiments and data analysis techniques.

UNIT I FUNDAMENTALS OF EXPERIMENTAL DESIGNS
Hypothesis testing – single mean, two means, dependant/ correlated samples – confidence intervals, Experimentation – need, Conventional test strategies, Analysis of variance, F-test, terminology, basic principles of design, steps in experimentation – choice of sample size – Normal and half normal probability plot – simple linear and multiple linear regression, testing using Analysis of variance.

UNIT II SINGLE FACTOR EXPERIMENTS
Completely Randomized Design- effect of coding the observations- model adequacy checking- estimation of model parameters, residuals analysis- treatment comparison methods-Duncan’s multiple range test, Newman-Keuel’s test, Fisher’s LSD test, Tukey’s test- testing using contrasts- Randomized Block Design – Latin Square Design- Graeco Latin Square Design – Applications.

UNIT III FACTORIAL DESIGNS
Main and Interaction effects - Two and three factor full factorial designs- Fixed effects and random effects model - Rule for sum of squares and Expected Mean Squares- 2^K Design with two and three factors- Yate’s Algorithm- fitting regression model- Randomized Block Factorial Design - Practical applications.

UNIT IV SPECIAL EXPERIMENTAL DESIGN
Blocking and Confounding in 2^K Designs- blocking in replicated design- 2^K Factorial Design in two blocks- Complete and partial confounding- Confounding 2^K Design in four blocks- Two level Fractional Factorial Designs- one-half fraction of 2^K Design, design resolution, Construction of one-half fraction with highest design resolution, one-quarter fraction of 2^K Design

UNIT V TAGUCHI METHODS
Design of experiments using Orthogonal Arrays, Data analysis from Orthogonal experiments- Response Graph Method, ANOVA- attribute data analysis- Robust design- noise factors, Signal to noise ratios, Inner/outer OA design.

TOTAL: 45 PERIODS

OUTCOME:
- Able to apply experimental techniques to practical problems to improve quality of processes / products by optimizing the process / product parameters.

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- Understanding the various materials and its properties contribution towards electrical and electronics field. This course covers the properties of materials behind the electronic applications.

UNIT I INTRODUCTION

UNIT II CONDUCTING MATERIALS
Introduction, factors affecting the conductivity of materials, classification based on conductivity of materials, temperature dependence of resistivity, Low resistivity materials (graphite, Al, Cu and steel) and its applications, high resistivity materials (manganin, constantin, nichrome, tungsten) and their applications. Superconductors: Meissner effect, classification and applications.

UNIT III SEMICONDUCTING AND MAGNETIC MATERIALS

UNIT IV DIELECTRIC AND INSULATING MATERIALS

UNIT V OPTOELECTRONIC AND NANO ELECTRONIC MATERIALS

OUTCOME:
- With the basis, students will be able to have clear concepts on electronic behaviors of materials

TEXT BOOKS:

REFERENCES:
2. Eugene A. Irene, Electronic Materials Science, Wiley, 2005