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OBJECTIVE:

To impart knowledge about the basics of lean principles, tools and techniques, and implementation in the construction industry.

UNIT I INTRODUCTION
Introduction and overview of the construction project management - Review of Project Management & Productivity Measurement Systems - Productivity in Construction - Daily Progress Report-The state of the industry with respect to its management practices -construction project phases - The problems with current construction management techniques.

UNIT II LEAN MANAGEMENT
Introduction to lean management - Toyota’s management principle-Evolution of lean in construction industry - Production theories in construction –Lean construction value - Value in construction - Target value design - Lean project delivery system- Forms of waste in construction industry - Waste Elimination.

UNIT III CORE CONCEPTS IN LEAN

UNIT IV LEAN TOOLS AND TECHNIQUES

UNIT V LEAN IMPLEMENTATION IN CONSTRUCTION INDUSTRY
Lean construction implementation- Enabling lean through information technology - Lean in design - Design Structure - BIM (Building Information Modelling) - IPD (Integrated Project Delivery) – Sustainability through lean construction approach.

TOTAL : 45 PERIODS

OUTCOME:

On completion of this course, the student is expected to be able to

CO1 Explains the contemporary management techniques and the issues in present scenario.
CO2 Apply the basics of lean management principles and their evolution from manufacturing industry to construction industry.
CO3 Develops a better understanding of core concepts of lean construction tools and techniques and their importance in achieving better productivity.
CO4 Apply lean techniques to achieve sustainability in construction projects.
CO5 Apply lean construction techniques in design and modeling.

REFERENCES:

OBJECTIVES:
- To study and understand the various quality and safety concepts and requirements applied to construction projects.

UNIT I QUALITY MANAGEMENT
Importance of quality; Elements of quality- quality characteristics- quality by design - quality conformance, contractor quality control- identification and traceability, Continuous Chain Management – brief concept and application. Importance of specifications - Incentives and penalties in specifications – Workmanship as a mark of quality – Final Inspection.

UNIT II QUALITY ASSURANCE AND CONTROL
Quality assurance techniques – Inspection, testing, sampling. Documentation – Organization for quality control, Cost of quality. Introduction to TQM, Six Sigma Concept in construction industry.

UNIT IV CONSTRUCTION ACCIDENTS

UNIT II SAFETY PROGRAMMES

UNIT V DESIGNING FOR SAFETY

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student is expected to be able to

CO1 Apply the quality standards for preparing Quality system documents.
CO2 Select the techniques and tools for Quality Assurance and Control in construction.
CO3 Develop the knowledge on accidents and their causes
CO4 Develop the knowledge about safety programmes & job-site safety assessment
CO5 Apply knowledge while designing for safety and safety procedures

REFERENCES:

AI5691 BASICS OF INTEGRATED WATER RESOURCES MANAGEMENT

OBJECTIVES
- To introduce the interdisciplinary approach of water management.
- To develop knowledge base and capacity building on IWRM.
UNIT I  OVERVIEW OF IWRM  9

UNIT II  WATER USE SECTORS: IMPACTS AND SOLUTION  9
Water users:  People, Agriculture, ecosystem and others - Impacts of the water use sectors on water resources - Securing water for people, food production, ecosystems and other uses - IWRM relevance in water resources management.

UNIT III  WATER ECONOMICS  9
Economic characteristics of water good and services – Economic instruments – Private sector involvement in water resources management - PPP experiences through case studies.

UNIT IV  RECENT TREANDS IN WATER MANAGEMENT  9
River basin management - Ecosystem Regeneration – 5 Rs - WASH - Sustainable livelihood - Water management in the context of climate change.

UNIT V  IMPLEMENTATION OF IWRM  9
Barriers to implementing IWRM - Policy and legal framework - Bureaucratic reforms and inclusive development - Institutional Transformation - Capacity building - Case studies on conceptual framework of IWRM.

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the student will be able to apply appropriate management techniques towards managing the water resources.

CO1  Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.

CO2  Discuss on the different water uses; how it is impacted and ways to tackle these impacts.

CO3  Explain the economic aspects of water and choose the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.

CO4  Illustrate the recent trends in water management.

CO5  Understand the implementation hitches and the institutional frameworks.

TEXT BOOKS

REFERENCES
2.  IWRM Guidelines at River Basin Level (UNESCO, 2008).
OBJECTIVES:
At the end of the course the students would be exposed to fundamental knowledge in
- Properties of Milk
- Processing of Milk and Manufacture of dairy products
- Sanitation and effluent treatment in dairy industry

UNIT I  PROPERTIES AND HANDLING OF MILK  7

UNIT II  PROCESSING OF MILK  9

UNIT III  DAIRY PRODUCTS  11

UNIT IV  MILK POWDER PROCESSING  8
Condensed Milk-Composition-Properties-Methods and Equipment-Processing of Milk Powder-Properties-Composition-Types-Manufacture of Milk Powder - Drum and Spray driers-Types of atomizers and flow patterns-droplet trajectory of milk.

UNIT V  PACKAGING, SANITATION AND EFFLUENT TREATMENT  10

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the student will be able to
CO1  get an idea of milk, its properties and how it is handled
CO2  understand the concept and methods of processing and packaging of milk and milk products
CO3  appreciate the different products of milk and the variations available in market
CO4  possess the knowledge of maintaining the dairy plant clean and sanitary
CO5  apply the knowledge of different branches of Engineering in milk processing

TEXT BOOKS:
REFERENCES:

GI5691 PHOTOGRAMMETRY L T P C
3 0 0 3

OBJECTIVE:
- To introduce basics and concepts of aerial photography, acquisition and mapping from aerial photographs using different types of stereo plotters

UNIT I INTRODUCTION 9

UNIT II TRANSFORMATIONS 9
Coordinate systems for Photogrammetry - Map projections, Datum and conversions- 2D and 3D Coordinate transformations: Affine, 7 Parameter Transformations - Collinearity and Space resection-Analytical stereomodel and relative orientation

UNIT III MAPPING 9

UNIT IV DIGITAL PHOTOGRAMMETRY 9

UNIT V APPLICATIONS 9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course, the student shall
- Acquire knowledge about photogrammetry principles, methods and products generation strategies in both Analytical and digital photogrammetry system.
- Understand the problem related to generation of products and solving them.

REFERENCES:
GI5692 TOTAL STATION AND GPS SURVEYING L T P C 3 0 0 3

OBJECTIVES:
- To understand the working of Total Station and GPS equipment and solve the surveying problems.

UNIT I FUNDAMENTALS 9

UNIT II ELECTROMAGNETIC WAVES 9
Classification - applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies- Refractive index (RI) - factors affecting RI-Computation of group for light and near infrared waves at standard and ambient conditions-Computation of RI for microwaves at ambient condition - Reference refractive index- Real time application of first velocity correction. Measurement of atmospheric parameters- Mean refractive index- Second velocity correction -Total atmospheric correction- Use of temperature - pressure transducers.

UNIT III ELECTRO OPTICAL AND MICRO WAVE SYSTEM 9

UNIT IV GPS SATELLITE SYSTEM 9
GPS - Different segments - space, control and user segments - satellite configuration - GPS signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability – Task of control segment - GPS receivers- Single and Dual Frequency Receivers- Survey Grade GPS – GNSS Satellite Constellations

UNIT V GPS DATA PROCESSING 9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of this course students shall be able to
- Understanding the concepts of Electromagnetic waves and impact of Refractive Index.
Work with Electro optical and microwave Total Station and understand error sources.
Understand the advantages of electronic surveying over conventional surveying methods
Understand the working principle of GNSS, its components, signal structure, and error sources
Understand various GNSS surveying methods and processing techniques used in GNSS observations
Familiarise various areas of GNSS applications and new developments.

REFERENCES:

EE5691 INTRODUCTION TO CONTROL SYSTEMS L T P C 3 0 0 3

OBJECTIVES
- To impart knowledge on various representations of systems.
- To familiarize time response analysis of LTI systems and steady state error.
- To analyze the frequency responses and stability of the systems
- To analyze the stability of linear systems in frequency domain and time domain
- To develop linear models mainly state variable model and transfer function model

UNIT I MATHEMATICAL MODELS OF PHYSICAL SYSTEMS 9
Definition & classification of system – terminology & structure of feedback control theory – Analogous systems - Physical system representation by Differential equations – Block diagram reduction–Signal flow graphs.

UNIT II TIME RESPONSE ANALYSIS & ROOTLOCUSTECHNIQUE 9

UNIT III FREQUENCY RESPONSE ANALYSIS 9
Correlation between Time & Frequency response – Polar plots – Bode Plots – Determination of Transfer Function from Bode plot.

UNIT IV STABILITY CONCEPTS & ANALYSIS 9

UNIT V STATE VARIABLE ANALYSIS 9
Concept of state – State Variable & State Model – State models for linear & continuous time systems–Solution of state & output equation–controllability & observability.

TOTAL:45 PERIODS

OUTCOMES:
Ability to
CO1: Design the basic mathematical model of physical System.
CO2: Analyze the time response analysis and techniques.
CO3: Analyze the transfer function from different plots.
CO4: Apply the stability concept in various criterion.

CO5: Assess the state models for linear and continuous Systems.

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TEXT BOOKS

REFERENCES
2. Control System Dynamics" by Robert Clark, Cambridge University Press, 1996 USA.

EE5692 ELECTRIC VEHICLE TECHNOLOGY

COURSE OBJECTIVES
- To provide knowledge about electric machines and special machine
- To understand the basics of power converters
- To know the concepts of controlling DC and AC drive systems
- To understand the architecture and power train components.
- To impart knowledge on vehicle control for standard drive cycles of hybrid electrical vehicles (HEVs)

UNIT I ROTATING POWER CONVERTERS

UNIT II STATIC POWER CONVERTERS
Working and Characteristics of Power Diodes, MOSFET and IGBT. Working of uncontrolled rectifiers, controlled rectifiers (Single phase and Three phase), DC choppers, single and three phase inverters, Multilevel inverters and Matrix Converters.

UNIT III CONTROL OF DC AND AC MOTOR DRIVES
Speed control for constant torque, constant HP operation of all electric motors - DC/DC chopper based four quadrant operation of DC motor drives, inverter based V/f Operation (motoring and braking) of induction motor drives, Transformation theory, vector control operation of Induction motor and PMSM, Brushless DC motor drives, Switched reluctance motor (SRM) drives
UNIT IV
HYBRID ELECTRIC VEHICLE ARCHITECTURE AND POWER TRAIN COMPONENTS

UNIT V
MECHANICS OF HYBRID ELECTRIC VEHICLES AND CONTROL OF VEHICLES
Fundamentals of vehicle mechanics - tractive force, power and energy requirements for standard drive cycles of HEV's - motor torque and power rating and battery capacity. HEV supervisory control - Selection of modes - power split mode - parallel mode - engine brake mode - regeneration mode - series parallel mode

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Able to understand the principles of conventional and special electrical machines.
CO2: Acquired the concepts of power devices and power converters
CO3: Able to understand the control for DC and AC drive systems.
CO4: Learned the electric vehicle architecture and power train components.
CO5: Acquired the knowledge of mechanics of electric vehicles and control of electric vehicles.

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REFERENCES:

ME5691
BASIC AUTOMOBILE ENGINEERING

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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Classifying the types of chassis and identify different class of automobiles
2. Outline the hybrid vehicle system architecture and their merits and demerits.
3. Illustrating the functions of various transmission systems.
4. Imparting the working of different braking and steering systems.
5. Understanding the working of electrical and electronic components

UNIT I INTRODUCTION
Types of automobiles, vehicle construction and different layouts, chassis, frame and body, Aerodynamic Drag, Specifications, Performance Parameters, Bharat New Vehicle Safety Assessment Program (BNVSAP) – Crash Test norms.

UNIT II HYBRID ELECTRIC VEHICLES
History and need for electric and hybrid vehicles, Concept of hybrid electric drive train, architecture of series and parallel hybrid electric drive train, merits and demerits, mild and full hybrids, plug-in hybrid electric vehicles and range extended hybrid electric vehicles. Fuel cell vehicles, comparison of diesel, petrol, electric and hybrid vehicles based on performance and emissions, limitations of electric vehicles and technical challenges

UNIT III TRANSMISSION SYSTEMS
Clutch-types and construction, gear boxes, manual and automatic, propeller shaft, slip joints, universal joints, Differential, and rear axle.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS

UNIT V SAFETY AND COMFORT SYSTEMS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Distinguish the different types of automobiles and chassis.
2. Interpret the various types of engines and their emission control.
3. Select the appropriate transmission systems.
4. Compare the braking and steering systems.
5. Infer the functions of different electrical and electronic components.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Applying the principles of generic development process; and understanding the organization structure for new product design and development.
2. Identifying opportunity and planning for new product design and development.
3. Conducting customer need analysis; and setting product specification for new product design and development.
4. Generating, selecting, and screening the concepts for new product design and development.
5. Testing and prototyping the concepts to design and develop new products.

UNIT I  INTRODUCTION TO PRODUCT DESIGN & DEVELOPMENT  9

UNIT II  OPPORTUNITY IDENTIFICATION & PRODUCT PLANNING  9

UNIT III  IDENTIFYING CUSTOMER NEEDS & PRODUCT SPECIFICATIONS  9

UNIT IV  CONCEPT GENERATION & SELECTION  9

UNIT V  CONCEPT TESTING & PROTOTYPING  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Apply the principles of generic development process; and understand the organization structure for new product design and development.
2. Identify opportunity and plan for new product design and development.
3. Conduct customer need analysis; and set product specification for new product design and development.
4. Generate, select, and screen the concepts for new product design and development.
5. Test and prototype the concepts to design and develop new products.

TEXT BOOK:

REFERENCES:

ME5693 APPLICATIONS OF 3D PRINTING TECHNIQUES  L T P C  3 0 0 3

OBJECTIVES:
1. To understand about concept of 3D printing
2. To appreciate the role of 3D printing in food technology
3. To appreciate the role of 3D printing in fashion technology
4. To appreciate the role of 3D printing in construction technology
5. To appreciate the role of 3D printing in healthcare Industry

UNIT I 3D PRINTING  9

UNIT II 3D PRINTING IN FOOD TECHNOLOGY  9
Printable food materials and properties, food product design- advantages & limitations, FOOD SAFETY LAWS AND REGULATION- Ethics- Software’s, Advantages, Limitations, Future Aspects, case studies.

UNIT III 3D PRINTING IN FASHION TECHNOLOGY  9
Printable materials and properties, Fashion & Apparel design, N-topology, Conductive textiles, Smart Wearable electronics, printed garments, Sportswear, software’s, Advantages, Limitations, Future Aspects, case studies.

UNIT IV 3D PRINTING IN CONSTRUCTION TECHNOLOGY  9
Printable materials and properties, Bio inspired designs, Advantages, Limitations, Future Aspects case studies.

UNIT V 3D PRINTING IN HEALTHCARE TECHNOLOGY  9
Printable materials and properties, Bio-printing, Modelling, pharmacology, forensic, Future Aspects

OUTCOMES:
The students will able to
1. Remember the role modern healthcare machines
2. Apply the concept of 3D printing in food technology
3. Apply the concept of 3D printing in fashion technology
4. Apply the concept of 3D printing in construction technology
5. Apply the concept of 3D printing in healthcare technology

REFERENCES:
ML5691 MATERIALS SELECTION

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<th>UNIT – I</th>
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UNIT – II MATERIAL PROPERTIES 

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<td>Significance for material design, Economic aspects, Mechanical properties-Density, Modulus, Damping, Yield Strength, Tensile Strength, Hardness, Fracture Toughness, Fatigue Strength, Thermal Fatigue Resistance, Creep Strength; Surface properties-Hardness, Modulus of Rupture, Surface Roughness and Friction Coefficient, Wear and Corrosion Rate and other functional properties, Ease of Manufacture, Joining and Aesthetic Properties</td>
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UNIT-III MATERIALS SELECTION FOR ENGINEERING APPLICATIONS – I 

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<td>Materials for Automotive applications, Aircraft applications, Case studies in materials selection for various applications – oar, table leg, flywheel, kiln walls, passive solar heating, heat exchangers, bearings, springs, pressure vessel, passive solar heating, ceramic valves.</td>
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UNIT – IV MATERIALS SELECTION FOR ENGINEERING APPLICATIONS – II 

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<td>Materials for Marine applications, Electrical and electronic industries, Case studies in materials selection for High temperature and cryogenic applications.</td>
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UNIT – V MATERIAL DESIGN 

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<td>Material attributes, Ashby process of Materials Selection, Performance Index, Material Index, Case study for Material selection using Ashby method, Constraints in Materials selection, Selection of materials against multiple constraints, Role of materials in shaping the product character. New frontiers in systems design of materials: Integrated Computational Materials Engineering</td>
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TEXT BOOKS:
1. M. F. Ashby, Materials Selection in Mechanical Design, Elsevier Publication, 2005

REFERENCES:

IE5691 INTRODUCTION TO INDUSTRIAL ENGINEERING

| OBJECTIVES: |
|-----------------|--------------------------|---|
| The objective of this course is to provide foundation in Industrial Engineering in order to enable the students to make significant contributions for improvements in diverse organizations. |
| Explain the concepts productivity and productivity measurement approaches. |
| Explain the basic principles in facilities planning and plant location. |
| Apply work study and ergonomic principles to design workplaces for the improvement of human performance |
| Impart knowledge to design and implement Statistical Process control in any industry. |
| Recognize the concept of Production and Operations Management in creating and enhancing a firm’s competitive advantages |
UNIT I   INTRODUCTION

UNIT II   PLANT LOCATION AND LAYOUT

UNIT III  WORK SYSTEM DESIGN & ERGONOMICS

UNIT IV   STATISTICAL QUALITY CONTROL

UNIT V   PRODUCTION PLANNING AND CONTROL

TOTAL: 45 PERIODS

OUTCOMES:
CO1: To understand the concepts of productivity and productivity measurement approaches.
CO2: Evaluate appropriate location models for various facility types and design various facility layouts
CO3: To conduct a method study and time study to improve the efficiency of the system.
CO4: Control the quality of processes using control charts in manufacturing/service industries.
CO5: The students will obtain sufficient knowledge and skill for Planning strategies and Material Requirement Plan.

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TEXT BOOKS:
2. Martand Telsang, 2006, Industrial Engineering and Production Management, S. Chand and Company

REFERENCES:
COURSE OBJECTIVES:
- To introduce the various automotive vehicle systems
- To impart knowledge on the various materials used for automotive components
- To study the production processes of automotive engine system.
- To production processes of automobile auxiliary systems
- To learn the advancements in automotive production

UNIT I  INTRODUCTION TO AUTOMOTIVE SYSTEMS  9
Introduction - Engine systems - Transmissions and driveline – suspensions and steering -
Tyres and wheels- Braking systems –Chassis system - Electrical system –HVAC system -
Engine control and Vehicle control systems - Emissions control system

UNIT II  MATERIALS FOR AUTOMOTIVE SYSTEMS  9
Selection of automotive materials – types of materials – Ferrous –Low, medium and high
carbon steels, Cast Irons– Nonferrous – Aluminum, Magnesium, Titanium, Copper and
Nickel alloys, Composites , Non-metallic materials –Polymers--Smart materials.

UNIT III  MANUFACTURING OF ENGINE SYSTEM  9
Manufacturing of Cylinder Block, Cylinder Head, Piston Assembly, Connecting Rod,
Crankshaft, Camshaft, Manifolds, and Valve Train- Fuel system –cooling system – ignition
system – Bearing and lubrication system

UNIT IV  MANUFACTURING OF AUXILIARY SYSTEMS  9
Manufacturing of Gear box, Clutch, propeller shaft - Suspensions and steering system -
Tyres and wheels - Braking systems –Chassis system - Electrical system - Emissions control system

UNIT V  ADVANCES IN AUTOMOTIVE SYSTEM  9
Manufacturing of Hybrid Vehicle, Electric vehicle, Traction batteries, Fuel-cell, Sensors and
actuators, intelligent vehicle systems - Automation and equipment technologies

TOTAL : 45 PERIODS

TEXT BOOKS:
1. Hiroshi yamagata, “The Science and Technology of materials in Automotive Engines”,

REFERENCES
2. Serope Kalpakjian and Steven R. Schmid, “Manufacturing Processes for Engineering
5. James D. Halderman and Chase D. Mitchell Jr. Automotive Engines: Theory and
6. Christopher Hadfield, Automotive Engineering: Engine Repair and Rebuilding, Delmar
Learning (Cengage Learning India Private Ltd.), 2010.

COURSE OUTCOMES:
At the end of the course, students will be able to:
- CO1: Identify different automotive system and its functions
- CO2: Select suitable materials and production process for automotive components
- CO3: Acquire complete knowledge on the production processes of automotive engine
system.
CO4: Understand the production process of automotive auxiliary systems.
CO5: Develop knowledge in the advancements in automotive production

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| CO3   | 0.9| 0.9     | 0.9     |         |         |         |         |         |         |         |         |         | 0.9  | 0.3     |         |         |
| CO4   | 0.9| 0.9     | 0.9     |         |         |         |         |         |         |         |         |         | 0.9  | 0.3     |         |         |
| CO5   | 0.9| 0.9     | 0.9     | 0.9     | 0.9     |         |         |         |         |         |         |         | 0.9  | 0.3     |         |         |

PT5691 DESIGN FOR PRINT MEDIA L T P C

OBJECTIVES
The students should be made to:
- Learn the basics of graphic design for printing.
- Understand the design requirements for various printed products.
- Learn the prepress workflow.
- Be familiar with various printing processes.
- Comprehend the print finishing processes.

UNIT I PRINCIPLES OF DESIGN 9
Design concept; Typography; Design elements; Design consideration; Layout – purpose & advantages; layout styles; layout components; stages in preparing a layout; marking-up; Software; Dummy, Case studies.

UNIT II DESIGNING FOR PRINT PRODUCTS 9
Standard sizes of printed products; Designing for Visiting Cards, Invitations, Books, Magazines, Business publications, Banners & Posters, Advertising, Packages; Case studies; Print buying - Specifications, cost estimation.

UNIT III PREPRESS 9
Additive and Subtractive colour theory; Continuous and halftone; Originals - text, image, graphics; Vector and Raster images; Image resolution, File formats and software; File submission requirements; Preflighting, Trapping, Proofing; Prepress workflow.

UNIT IV PRINTING PROCESSES 9
Types of process – Letterpress, Offset, Gravure, Flexography, Screen printing, Digital Printing Processes; Variable data printing, Print on Demand, Web to print, Security printing, Selection criteria; Applications.

UNIT V PRINT FINISHING 9
Standard Paper sizes; Value additions to printed products; Types of finishing process - cutting, folding, binding, coating, hot foil stamping, die-cutting, embossing, pouching; Digital print finishing; Selection criteria, Applications.

OUTCOMES:
Upon completion of the course, the student should be able to:
- Apply principles of design in the ideation of print products.
- Classify the print products.
- Summarize requirements for preparing print ready file.
- Interpret the print specifications and select suitable printing process.
- Utilize relevant print finishing methods to enhance value of printed product.

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCES:

PT5692 VISUAL COMMUNICATION FOR DIGITAL MEDIA L T P C
3 0 0 3

OBJECTIVES
- To understand the nature and purpose of visual analysis.
- To explore how to blend different types of approaches and useful tools with visual content.
- To understand different types of visual breakdown and theories related to it.
- To study the models for analysis.
- To understand different types of visual analysis and evaluations.

UNIT I INTRODUCTION TO VISUAL ANALYSIS 9
Design and communication – visual communication design–Visual analysis: Definition and different perceptions – Methods and Scope of visual communication – Unit of analysis – Image analysis – Text, context, form, colour, social practice in media.

UNIT II TYPES OF DIGITAL MEDIA 9
Elements of design- principles of design -Typography – design semiotics- syntax- semantics – pragmatics; visual perception- visual language. Visual design methodology- generic , graphic - web design.

UNIT III QUANTITATIVE APPROACH 9

UNIT IV COMMUNICATION AS A PROCESS 9
Communication – types problems-semiotics- polysemy -Perception and meaning- design methods – design process- types- contemporary – modern design principles.

UNIT V VISUAL AESTHETICS 9

TOTAL: 45 PERIODS

OUTCOMES
At the end of the course, the student will be able to:
- Understand the scope and limitations of visual media.
- Identify the range of approaches to visual analysis.
- Learn the different visual representation techniques and its applications.
- Understand the theories of visual analysis.
- Learn to analyze and evaluate visual content.
REFERENCES

CS5691 BIG DATA ANALYTICS

OBJECTIVES
- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To familiarize with different Recommendation system
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

UNIT I INTRODUCTION TO BIG DATA

UNIT II CLUSTERING AND CLASSIFICATION

UNIT III RECOMMENDATION SYSTEM

UNIT IV GRAPH MEMORY AND STREAM MEMORY

UNIT V NO SQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION

TOTAL: 45 PERIODS
OUTCOMES:
Upon completion of the course, the students will be able to:

- Work with big data tools and its analysis techniques
- Design efficient algorithms for mining the data from large volumes
- Design an efficient recommendation system
- Design the tools for visualization
- Learn NoSQL databases and management

TEXT BOOKS:

REFERENCES:

CS5692 WEB DESIGN AND MANAGEMENT L T P C 3 0 0 3

OBJECTIVES:
- To learn the concepts of Web design and its types.
- To understand the basic concepts of HTML
- To understand and learn the scripting languages with design of web Applications.
- To understand the concepts of web hosting and SEO.
- To learn the SQL queries to retrieve/store data from/to database.

UNIT I INTRODUCTION 9
Basic principles involved in developing a web site, Planning process, Domains and Hosting, Responsive Web Designing, Types of Websites (Static and Dynamic Websites), Introduction to HTML: What is HTML, HTML Documents, Basic structure of an HTML document, Creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags., Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls.

UNIT II CONCEPT OF CSS 9
Creating Style Sheet, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements and objects, Working with Lists and Tables, CSS Id and Class, Box Model (Introduction, Border properties, Padding Properties, Margin properties) CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector), CSS Color, Creating page Layout and Site Designs.
UNIT III  SCRIPTING LANGUAGES
Introduction to Client Side Scripting, Introduction to Java Script, Javascript Types, Variables in JS, Operators in JS, Conditions Statements, Java Script Loops, JS Popup Boxes, JS Events, JS Arrays, Working with Arrays, JS Objects, JS Functions, Using Java Script in Real time, Validation of Forms, Related Examples

UNIT IV  WEB HOSTING

UNIT V  DATABASE: SQL, ADO.NET 2.0 AND JAVA DB

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- Visualize and Recognize the basic concept of HTML and application in web designing.
- Recognize and apply the elements of Creating Style Sheet (CSS).
- Understanding the basic concept of Java Script and its application.
- Introduce basics concept of Web Hosting and apply the concept of SEO
- Retrieve data from/to data from the database using SQL.

REFERENCES:
4. Steven M. Schafer, “HTML, XHTML, and CSS Bible, 5ed”, Wiley India, 2010

EC5691  AUTOMOTIVE ELECTRONICS
L T P C
3 0 0 3

OBJECTIVES:
- To make the students to understand the concepts of electronics components, and the design of various combinational circuits.
- To introduce the Microcomputer Instrumentation and Electronics engine control
- Ability to understand sensor based electronics applications.
- To introduce the motion control, Instrumentation and Telematics.
- To impart knowledge on future automotive systems.

UNIT I  AUTOMOTIVE AND ELECTRONICS FUNDAMENTALS

UNIT II  MICROCOMPUTER INSTRUMENTATION AND ELECTRONICS ENGINE CONTROL
UNIT III SENSORS AND ACTUATORS

UNIT IV MOTION CONTROL, INSTRUMENTATION AND TELEMATICS

UNIT V DIAGNOSIS AND FUTURE AUTOMOTIVE SYSTEMS

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES:
2. Ribbens William, “Understanding Automotive Electronics”, Elsevier – Health Sciences Division, 2020

COURSE OUTCOMES:
CO1: Recognize electronics components required for automotive electronic based systems.
CO2: Ability to design microcomputer Instrumentation and Electronics Engine Control.
CO3: Gain knowledge to design sensor based electronic applications.
CO4: Comprehend vehicular communication and motor control concepts in automotive engineering.
CO5: Exposure to future automotive systems.

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COURSE OBJECTIVES:

- To understand the basic concepts of electronics components.
- To learn about construction and working of basic electronic devices.
- To impart knowledge on Boolean algebra and design various combinational and sequential circuits.
- To introduce the Integrated circuits design and fabrications and related technology.
- To design sensor based electronics applications.

UNIT I       ELECTRONIC COMPONENTS  9

UNIT II      BASIC ELECTRONIC DEVICES AND ITS WORKING:  9

UNIT III: DIGITAL ELECTRONICS  9

UNIT IV      INTEGRATED CIRCUITS  9
Evolution and Inventors of Integrated Circuits – Structure, Scale/Level, Classification, Surface Mount Devices and Surface Mount Technology, Printed Circuit Boards, Semiconductor Manufacturing Case Study.

UNIT V:      ELECTRONICS SYSTEMS  9

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
6. www.semiconductors.org/main/resources
8. www.tsunami.noaa.gov
Course Outcomes:
CO1: Acquire knowledge on electronics components required for electronic based systems.
CO2: Comprehend basic electronic devices working.
CO3: Explore to design digital electronic systems.
CO4: Gain knowledge on design and fabricate PCB’s
CO5: Analyze and design sensor based electronics applications.

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EC5693 WIRELESS TECHNOLOGIES

OBJECTIVES:
- To provide basic understanding about wired and wireless communication.
- To have an exposure to Internet of Things and applications.
- To understand the basic wireless network security.
- To get exposed to antenna systems.
- To understand various satellite communication.

UNIT I FUNDAMENTALS OF COMMUNICATION

UNIT II INTERNET OF THINGS
Introduction, IoT- Architecture, IEEE 802.15.4, M2M and IoT Protocols, SCADA and RFID Protocols, Architecture and Applications - Bluetooth, Zigbee, LORA, 6LOWPAN, Wi-Fi, WIMAX.

UNIT III WIRELESS NETWORK SECURITY

UNIT IV ANTENNA SYSTEMS
Introduction, Types of Antennas, Radiation Mechanisms and Measurements, Dipole, Monopole, Mobile Phone Antenna, Smart Antennas, RFID antennas, Automotive Antenna, Reconfigurable Antennas, SAR measurements.

UNIT V SATELLITE COMMUNICATION

TOTAL: 45 Periods

TEXT BOOK:

REFERENCES:

Course outcomes:
- To be able to analyze the wired and wireless communication and networks.
- To be able to develop Internet of Things for various applications.
- To be able to apply security protocols in Wireless Networks.
- To be able to acquire the antenna systems for Wireless Technologies.
- To be able to explain the Satellite Communication technologies.

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EC5694 MICROCONTROLLER PROGRAMMING L T P C

COURSE OBJECTIVES
- To study different microcontroller internal architectures.
- To learn the assembly language and C programming - microcontrollers.
- To learn the interfacing concepts in microcontrollers.
- To design a microcontroller system with different basic hardware.
- To program the microcontroller for real time applications – case study.

UNIT I INTRODUCTION TO 8051 MICRO CONTROLLER 9
Overview of 8051 Micro Controller, Architecture, I/O ports and Memory Organization, Interrupts, Timer/Counter and Serial Communication, Programming in Assembly language.

UNIT II INTRODUCTION TO PIC MICROCONTROLLER 9
UNIT III  PROGRAMMING WITH C
Introduction to C - Microchip MPLAB IDE - CCS PCM C compiler - Proteus VSM - Microchip PICDEM Mechatronics board, case study.

UNIT IV  APPLICATIONS OF 8051
Human interface from switches to keypads - LED displays - LCD - interfacing to the physical world: simple sensors: micro switch, Light-dependent resistors, Optical object sensing, opto-sensor applied as a shaft encoder, Ultrasonic object sensor - Actuators: DC and stepper motors - Interfacing to actuators, case study.

UNIT V  APPLICATIONS OF PIC MICROCONTROLLERS
LED Chasing circuit - Four digit LED Display interface, Interrupt driven event counter with 4-digit LED display - Simple Buzzer interface, Speaker interface - Electronic Siren - Interfacing Digital temperature sensor - Analog temperature sensor IC with A/D converter, case study.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able to:
- Know the internal architecture of the microcontrollers.
- Program in assembly and C with microcontrollers.
- Understand the basic hardware interfacing with microcontroller system.
- Find effective solutions to a wide range of real-world microcontroller applications.
- Design a case study using microcontroller.

TEXT BOOKS:

REFERENCES:

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BM5691 MANAGEMENT OF WASTES IN HOSPITALS  L T P C
3 0 0 3

OBJECTIVES:
The student should be made:
- To understand the importance of handling wastes and proper disposal.
- To teach the students about regulatory requirements of waste management.
- To study the concept of sterilization and challenges behind infectious wastes.
- To create Knowledge about hospital wastes disposal methods.
- To understand the techniques involved in hazard identification and Risk management.
UNIT I  INTRODUCTION TO WASTES
Hospital waste, types of medical waste, hazardous waste, infectious waste, Microbial and pathological wastes, Elements of waste management, hospital waste categorization.

UNIT II  WASTE REGULATION IN INDIA
Environment protection Act and rules, Regulation and control rules, Management, handling and transboundary movements.

UNIT III  STERILIZATION TECHNIQUES
Transmission of disease, related pathogens, infections and disinfectants, steam sterilization, microwave sterilization, EtO/OEO sterilization and dry heat techniques.

UNIT IV  WASTE DISPOSAL METHODS
Solid waste disposal, liquid waste disposal, hazardous and radioactive wastes destruction, waste reduction methods, incinerator, crematories.

UNIT IV  SAFETY AND RISK ASSESSMENT
Risk management in hospitals, hazard identification and risk assessment, Environmental issues in hospitals and safety issues, Risk analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student should be able to:
CO1: Describe the importance of handling wastes and proper disposal.
CO2: Explain about regulatory requirements of waste management
CO3: Comprehend the Challenges against the infectious waste.
CO4: Apply various waste disposal methods.
CO5: Describe the importance of safety and risk assessment techniques.

TEXT BOOKS:
2. Tarannum Dana, Medical Waste Management, July 2012.

REFERENCES:

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OBJECTIVES:
The student should be made to:
- Learn the classification and characteristics of Biomaterials.
- Understand different types of materials used as biomaterials.
- Comprehend the response of the living system towards the biomaterials.
- Introduce various applications of biomaterials and identify areas of research opportunities.
- Learn the standards and rules involved in developing biomaterials.

UNIT I  DEFINITIONS AND PROPERTIES  9
Definition for biomaterials- biocompatibility-biodegradation- criteria for choosing a biomaterial- use of biomaterials in medicine-physical and chemical properties, surface properties and surface characterization.

UNIT II  CLASS OF MATERIALS  9

UNIT III  RESPONSE TO MATERIALS  9

UNIT IV  APPLICATIONS OF BIOMATERIALS  9
Cardiac assist device- non thrombogenic treatments- dental implants- orthopedic applications- dermal treatments- ocular and extracorporeal implants.

UNIT V  STANDARDS AND NEW PRODUCTS  9
Rules and regulations for developing medical products- standards-material evaluation- legal aspects of biomaterials- ethical issues in developing biomaterials.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student should be able to:
CO1: Understand the important concepts of biomaterials and their contribution towards Biomedical Engineering.
CO2: Perform combinations of materials that could be used as implants.
CO3: Evaluate response of biomaterials in living system.
CO4: Analyze different applications of biomaterials in biomedical field.
CO5: Assimilate information on the standards and rules involved in developing biomaterials.

TEXT BOOKS:

REFERENCES:
5. Materials Science and Technology: Volume 14, Medical and Dental Materials: A comprehensive Treatment Volume Editor D F Williams, VCH Publishers 1992

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<td>CO5</td>
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OBJECTIVES:
- To provide a basic knowledge of computer hardware and software.
- To familiarize with the basic taxonomy and terminology of computer networking.
- To design and develop web pages using HTML and CSS.
- To understand the general concepts of PHP scripting language and MySQL functionalities for the development of simple data-centric applications.
- To understand fundamental concepts of mobile communication and various types of information systems and their complexities.

UNIT I  HARDWARE AND NETWORK ESSENTIALS

Suggested Activities:
- Explore the web to know more about the networking concepts and recent technologies. Students may present their findings orally or by a written report or through discussion forums.
- Explore the networking devices used in laboratories and homes, and their configurations.

Suggested Evaluation Methods:
- Quizzes on network transmission and communication.
- Report evaluation by peers.
- Discussion on network devices.

UNIT II  WEB ESSENTIALS

Suggested Activities:
- Browse the internet on special topics given by instructor.
- Learn HTML basic tags for web page design.
- Practical - Design of a small simple website, interlinking set of web pages created using the HTML tags and CSS.

Suggested Evaluation Methods:
- Quizzes on all the topics.
- Peer evaluation of the simple websites created.

UNIT III  CLIENT-SIDE SCRIPTING ESSENTIALS
Need for Scripting Languages – Introduction to JavaScript - Variables and Assignments - Writing Functions – Built-in functions and methods - Object Oriented JavaScript - JavaScript Loops – Events – JavaScript Forms - JavaScript Cookies and AJAX.

Suggested Activities:
- Implementing simple JavaScript programs.
- Identify different types of form validations in the websites that are commonly used.
- Creation of Dynamic Web Pages.

Suggested Evaluation Methods:
- Demonstration of the implementations.
- Discussion on form validation.
UNIT IV  SERVER-SIDE SCRIPTING ESSENTIALS


Suggested Activities:
- Implementing simple programs using PHP.
- Designing dynamic web pages using PHP.
- Database creation using MySQL and linking with the PHP scripts.
- Incorporating of session and cookies.

Suggested Evaluation Methods:
- Demonstration of the implementations.
- Assignment problems.
- Quizzes

UNIT V  MOBILE AND APPLICATION ESSENTIALS


Suggested Activities:
- Flipped classroom on generations of cellular networks.
- Explore the web to know more about the concepts and technologies used for the design of Information Systems. Students may present their findings orally or by a written report.
- Design a simple web or mobile application.
- Explore and analyse some of the visual analytics software.
- Flipped classroom on social networking applications.

Suggested Evaluation Methods:
- Quizzes on features of social networking applications.
- Presentations on various information systems.
- Demonstration of application.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the student will be able to:
- understand the basic concepts of hardware, data communications and networking.
- create dynamic websites that meet specified needs and interests using HTML5, and CSS.
- understand the basic concepts and analyse their impact on problem solving and demonstrate concepts by building web pages generated by JavaScript programming.
- create responsive web sites using the PHP, and MYSQL databases.
- identify the fundamental concepts of mobile communications and key issues in the design of commonly used applications.
- create web-based applications using HTML5, PHP, and MYSQL database.

TEXTBOOKS

REFERENCES
OBJECTIVES:
- To understand the fundamentals of Internet of Things.
- To build a small low-cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To learn communication protocols that are frequently used in IoT ecosystems.
- To explore the ways of processing enormous amount of data generated in IoT based systems.
- To understand the importance of visualization in IoT analytics.

UNIT I  ENABLING TECHNOLOGIES AND REFERENCE MODELS


Suggested Activities:
- Flipped classroom on enabling technologies.
- External learning – Exploring proprietary protocols used in IoT and M2M.
- Analysing the required level of design for different IoT based ecosystems.

Suggested Evaluation Methods:
- Quiz and discussion on enabling technologies (WSN, Cloud and Big Data).
- Assignments on proprietary protocols used in IoT and M2M.
- Deciding the level and designing the IoT framework for case studies

UNIT II  DESIGN OF END DEVICES


Suggested Activities:
- Flipped classroom on open-source movement in hardware and SDLC for embedded systems.
- Explore the variants of Arduino Boards, Atmel Microcontrollers, Cypress Pioneer and NXP Freedom.
- Learning to write Arduino Sketches and Python programs.

Suggested Evaluation Methods:
- Quiz and discussion on open-source movement in hardware and SDLC for embedded systems.
- Assignments on Arduino boards, Atmel Microcontrollers, Cypress Pioneer and NXP Freedom.
- Practical – Developing Arduino Scripts and Python programs

UNIT III  IoT PROTOCOLS

MAC Layer Protocols – IEEE 802.15.4 – G and E Variants of IEEE 802.15.4 – IEEE 802.11ah – IEEE 1901.2a – LoRaWAN – 6LoWPAN – From 6LoWPAN to 6Lo – NBIoT – REST Based Protocols – CoAP and MQTT.

Suggested Activities:
- External learning – Explore various software tools that support CoAP and MQTT.
Flipped classroom on role of Lpv6 in designing IoT based systems.

Suggested Evaluation Methods:
- Assignments on software tools that support Coap and MQTT.
- Quiz and discussion on role of Lpv6 in IoT based systems.
- Assignments on the IoT policy of Meity (Government of India).

UNIT IV  IoT ANALYTICS


Suggested Activities:
- Flipped classroom on software and management tools for IoT analytics.
- External learning – Visualization tools.

Suggested Evaluation Methods:
- Quiz and discussion on different visualization methods.
- Demonstration on various visualization tools

UNIT V  INDUSTRIAL IoT AND CASE STUDIES

Industrial IoT adoption – IIoT Challenges, Drivers and Taxonomies – Industry 4.0 - Areas of IIoT Adoption –Tools and Technologies assisting IIoT – Case studies, Retail Industry, Home automation, Energy management, Health care and Workflow Management.

Suggested Activities:
- External learning – Industry 5.0 (Exploring scalability, security, and customization).
- Flipped classroom on IIoT business Models.
- Learning and Imbibing Green IoT.

Suggested Evaluation Methods:
- Assignments on emerging areas of Industry 5.0.
- Quiz and group discussion on technologies for IIoT business Models.
- Practicing green framework for IoT application (expeditionary learning- project based)

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the student will:
- Understand the enabling technologies and reference models of IoT.
- Design portable IoT devices using Arduino IDE/ Raspberry Pi with Python.
- Apply appropriate protocols in various parts of IoT based systems.
- Understand the importance of visualization in analytics part of IoT systems.
- Understand Big Data tools and technologies and apply them in IoT based systems.
- Design IoT systems for various real time applications.

TEXTBOOKS
1. RMD Sundaram Shriram K Vasudevan, and Abhishek S Nagarajan, “Internet of Things”, Wiley, 2019
REFERENCES

IT 5693   BLOCKCHAIN TECHNOLOGIES   L T P C
                      3 0 0 3

OBJECTIVES:
- To provide an introduction to the basic principles of cryptography
- To explore the working mechanism of Blockchain technology
- To learn bitcoin related methodologies.
- To understand distribution consensus related techniques
- To explore the emerging technologies in Blockchain networks
- To develop decentralized applications using various tools

UNIT I   INTRODUCTION TO BLOCKCHAIN and CRYPTOGRAPHY


Suggested Activities:
- Flipped classroom on studying cryptographic functions
- Implementation of hashing algorithms.
- Verifying message authentication using digital signatures
- Exploring Blockchain
- Developing application to issue transaction

Suggested Evaluation Methods:
- Assignment to be given on public crypto systems and Digital signatures

UNIT II  BITCOIN MECHANICS


Suggested Activities:
- Creating Bitcoin wallet
- Creating Bitcoin raw transaction and adding to blockchain
- Creating and validating Bitcoin transaction
- Exploring Proof of Work(PoW)
- Flipped classroom on Cryptocurrency.

Suggested Evaluation Methods:
- Practical exercises to be given for creating Bitcoin scripts

UNIT III   ETHEREUM

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain- EVM - Smart Contract -Solidity.
Suggested Activities:
- External learning - Exploring Ethereum tools like Ganache and GO. Practical - Setup the Ethereum development environment.

Suggested Evaluation Methods:
- Evaluation of developed smart contract on private Blockchain

UNIT IV BLOCKCHAIN DEVELOPMENT FRAMEWORKS


Suggested Activities:
- External learning - Developing Ethereum applications
- Practical - Setup the Dapps development environment

Suggested Evaluation Methods:
- Evaluation of decentralized application using Web3.0

UNIT V APPLICATIONS AND EMERGING TRENDS

Distributed applications - Blockchain interoperability - Non-Fungible Tokens (NFTs)- Scalability -Alt coins- Case studies.

Suggested Activities:
- Assignments on emerging Blockchain tools.
- Exploring NFTs.
- Presentation on Altcoins.

Suggested Evaluation Methods:
- Practical assessment for developing Blockchain applications in respective domains.

COURSE OUTCOME

On completion of course the students will be able to
1. Explain the technology components of Blockchain and decentralized applications
2. Analyze the choices in Bitcoin and identify its pros and cons
3. Develop smart contracts using Ethereum with an understanding of the components of Ethereum.
4. Demonstrate usage of different Blockchain development frameworks
5. Evaluate recent developments in Blockchain Tools and Altcoins.
6. Develop Blockchain applications for different domains.

TEXTBOOKS

REFERENCES:
OBJECTIVES:
- To understand the concepts of machine learning.
- To appreciate Classification and Regression algorithms.
- To understand SVM and ANN algorithms
- To understand the clustering algorithms.
- To appreciate the concepts and algorithms of reinforcement learning.
- To know about probabilistic graphic models.

UNIT I  INTRODUCTION TO MACHINE LEARNING  9

Suggested Activities:
- Install python and explore the packages required for machine learning including numpy, scikit-learn, and matplotlib.

Suggested Evaluation Methods:
- Quiz on different applications of machine learning.

UNIT II  SUPERVISED LEARNING - I  9

Suggested Activities:
- Practical – Collection of data from different recourses and summarize the data.
- Practical – Build linear, multi-linear, logistic Regression model to predict the data.

Suggested Evaluation Methods:
- Evaluation of the practical implementations using the T-test set.
- Group discussion on basics of classification and regression.

UNIT III  SUPERVISED LEARNING II  9

Suggested Activities:
- Practical – Develop SVM model for a two-class problem, whose training points are distributed in a 2D plane and improve the performance of the model by applying kernel methods.
- Practical – Implement bagging approach for credit card analysis.

Suggested Evaluation Methods:
- Tutorial – Kernel methods.
- Evaluation of the practical implementations using appropriate test set.
- Group discussion on back propagation.

UNIT IV  UNSUPERVISED LEARNING  8

Suggested Activities:
- Implement k-means algorithm to cluster the traffic data set based on accident type.
Suggested Evaluation Methods:
- Tutorial on model selection and validation.
- Evaluation of the practical implementation using appropriate test set.

UNIT V  PROBABILISTIC GRAPHICAL MODELS


Suggested Activities:
- Assignment on solving numerical problem using HMM.

Suggested Evaluation Methods:
- Group discussion on graphical models.

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course, the student will:
- Implement a neural network for an application of your choice using an available tool.
- Implement probabilistic discriminative and generative algorithms for an application of your choice and analyze the results.
- Use a tool to implement typical clustering algorithms for different types of applications.
- Design and implement an HMM for a sequence model type of application.
- Implement a PGM for any real time application using an open-source tool.
- Identify applications suitable for different types of machine learning with suitable justification.

TEXTBOOKS

REFERENCES

LT5691  BIOTECHNOLOGICAL APPLICATION IN LEATHER MANUFACTURE

UNIT I  NUCLEIC ACID, PROTEINS & ENZYMOLOGY


UNIT II  GENETIC ENGINEERING (RECOMBINANT DNA TECHNOLOGY)

Principles and methods, Essentials of biotechnology-products of biotechnology, Restriction enzymes, vectors, DNA cloning strategies.

UNIT III  BIOTECHNOLOGY FOR HIDES/SKINS IMPROVEMENT


UNIT IV  WASTE MANAGEMENT

General features of the organic and inorganic pollutants of tannery. Stabilisation and disposal of organic and chemical wastes and their biological treatment. Possible energy generation from wastes.
UNIT V UTILISATION OF COLLAGENOUS BIOPRODUCTS

Purification of collagen; Preparation of collagenous biomaterials; Gelatin extraction; Use of Collagen/gelatin in food and beverages; Collagen use in cosmetic and medical fields

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the student will understand basic biotechnology concepts and its relevance for application in leather processing.

- CO-1 Have a basic understanding about DNA, Proteins and Enzymes.
- CO-2 Able to understand the principles of genetic engineering
- CO-3 Have knowledge in enzyme for leather processing.
- CO-4 Gain knowledge on biotechnological aspects in tannery waste management
- CO-5 Gain knowledge on various application of collagen

**Course Articulation Matrix: BIOTECHNOLOGICAL APPLICATION IN LEATHER MANUFACTURE**

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<tr>
<th>CO</th>
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<tr>
<td>CO-1</td>
<td>Have a basic understanding about DNA, Proteins and Enzymes</td>
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<td>CO-2</td>
<td>Able to understand the principles of genetic engineering</td>
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<td>CO-3</td>
<td>Have knowledge in enzyme for leather processing</td>
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<td>CO-4</td>
<td>Gain knowledge on biotechnological aspects in tannery waste management</td>
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<td>CO-5</td>
<td>Gain knowledge on various application of collagen</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

**TEXT BOOK AND REFERENCES**

OBJECTIVE
To impart knowledge on making leather goods and garments

UNIT I  OVERVIEW ON LEATHER PRODUCTS  9
Different life style products from leather; Classification of Leather Goods and Garments; Selection of Materials, grading and assorting of leathers for leather goods and garments; Property requirements for leather and other materials; Accessories for Leather goods and garments - Various types of fasteners, fittings and other accessories. Alternative materials and their adaptability for goods and garments. Operational sequences in leather goods and garments production.

UNIT II  OPERATIONS IN LEATHER GOODS/GARMENTS  11
i) Production planning - Nomenclature used for component identification in various leather garments skirts, jackets, trousers etc and various leather goods – Wallet, hand bags, Executive bags etc. Process scheduling and line balancing.
iii) Assembling- Pre assembly and assembly operations – skiving, splitting, folding, sewing etc. Various types of assembly techniques for leather goods and garments.
iv) Quality - Quality control measures in leather products manufacture.

UNIT III  LEATHER PRODUCTS MACHINERY  9
Machinery needs for leather goods and garments manufacture. Various types of sewing machines – flat bed, cylinder bed, post bed and other special sewing machines – different feed mechanisms. Clicking, splitting, skiving, folding, embossing, creasing machines – their working principles operation and maintenance.

UNIT IV  DESIGN AND DEVELOPMENT  9
Pattern design and development – measurement/ sizing for various types of garments, pattern design of leather goods and garments, pattern grading for leather garments. CAD applications for leather goods and garments. Fashion and material trends.

UNIT V  ORGANISATION AND MANAGEMENT  7

TOTAL: 45 PERIODS

OUTCOMES:
On the completion of the course students are expected to
CO1.To gain orientation on various products made from leather; various materials and components for the manufacture of leather goods and garments.
CO2.To understand various operations involved in making of leather good and garments.
CO3.To understand the working principle, operation and maintenance of different machineries used for making leather goods and garments
CO4.To gain fundamental knowledge on design and development of leather goods and garments
CO5.To understand organisation and management of leather goods and garments manufacturing unit.
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<th>PS O1</th>
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<tbody>
<tr>
<td>CO-1</td>
<td>To know various materials and components for the manufacture of leather goods and garments.</td>
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<td>CO-2</td>
<td>To understand various operations involved in making of leather goods and garments.</td>
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<td>CO-3</td>
<td>To understand the working principle, operation and maintenance of different machineries used for making leather goods and garments.</td>
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<td>CO-4</td>
<td>To gain fundamental knowledge on design and development of leather goods and garments.</td>
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<tr>
<td>CO-5</td>
<td>To understand Organisation and management of leather goods and garments manufacturing unit.</td>
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</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
TEXT BOOK AND REFERENCES:
6. A course manual on leather garment pattern designing.
8. Leather and sports goods – Pattern and Template marker, NIMI Publications, 2011

TT5691 TECHNICAL FIBRES

OBJECTIVES
- To enable the students to learn about production, properties and application of various technical fibres

UNIT I
Introduction: Classification of textile fibres according to their nature and origin, essential and desirable properties of textile fibres, staple fibre and continuous filament, comparison of natural and manmade fibres.

UNIT II
Linear polymer fibres, polyamide fibres, high modulus-high tenacity polyethylene and other such fibres; their structure, properties and applications.

UNIT III
Carbon fibres, classification – based on raw materials, heat treatment, strength and modulus; physical properties and applications glass fibres, classification, principle of fibre manufacturing, physical properties and applications.

UNIT IV
Chemical resistance fibres- their structure, properties and applications; thermal resistance fibres, their structure, properties and applications.

UNIT V
Ceramic fibres, classification, effect of heat treatment on properties, physical properties and applications; derivatives of ceramic fibres; hollow and profiled fibres- properties and applications.

TOTAL : 45 PERIODS

COURSE OUTCOMES
Upon the completion of this course, the students will have knowledge on
- CO1: Classification and properties of textile fibres
- CO2: Properties and applications of high modulus-high tenacity fibres
- CO3: Properties and applications of carbon fibres
- CO4: Properties and applications of chemical resistant fibres
- CO5: Properties and applications of ceramic, hollow and profiled fibres

TEXT BOOKS
OBJECTIVES

- To impart knowledge on the machineries and equipments used for garment production
- To instruct on latest developments in the garment production machineries.

UNIT I  FABRIC INSPECTION AND SPREADING MACHINES  9

UNIT II  CUTTING MACHINES  9
Mechanism of straight knife cutting machines, rotary cutting machines, band knife cutting machines, die cutting, laser cutting, plasma cutting, water jet cutting and ultra-sonic cutting; Notches, drills and thread markers; computer interfaced cutting machines.

UNIT III  SEWING MACHINES  9
Lock stitch and chain stitch sewing machine - types, driving arrangement, function of elements, stitch formation, timing, settings and feed mechanism; needles – geometry, types and selection of machine and process parameters for different applications.

UNIT IV  SPECIAL SEWING MACHINES  13
Over lock, flat lock, feed off arm, button fixing and button holing – driving arrangement, stitch formation, timing, settings and feed mechanism.

UNIT V  FINISHING MACHINES  5
Pressing machineries – buck pressing, iron pressing, block or die pressing, form pressing, steamers and advanced pressing machineries; folding and packing machines.

TOTAL: 45 PERIODS

COURSE OUTCOMES
After successful completion of this course, the students would understand the,

CO1: Principle and working of machines used for fabric inspection and spreading
CO2: Principle and working of fabric cutting machines
CO3: Construction and working principle of sewing machines
CO4: Construction and working principle of special sewing machines
CO5: Construction and working principle of finishing machines used for garment manufacture.

TEXT BOOKS

CT5691  CERAMICS MATERIALS FOR ENGINEERS  3 0 0 3

COURSE OBJECTIVE
The course is aimed to

- To understand the traditional ceramic materials, its characteristics and applications
- To understand about the structure and properties of glass and glass ceramics
- To understand the structure and properties of advanced ceramic materials
- To gain knowledge on the ceramic materials used for functional applications
- To understand the ceramic materials used for biological applications
UNIT I CLASSIC CERAMICS

UNIT II GLASS AND GLASS CERAMICS

UNIT III ADVANCED CERAMICS
Introduction - Synthesis, Structure, Properties and applications of oxides and its based materials – alumina, mullite, spinel, zirconia, titania, non oxides – carbides – boron carbide, silicon carbide, nitrides – boron nitride, silicon nitride, aluminium nitride, silicon nitride, SiAlONs

UNIT IV FUNCTIONAL CERAMICS

UNIT V BIOCERAMICS

TOTAL : 45 PERIODS

COURSE OUTCOMES
After the completion of the course, the students will be able
CO1 To apply the traditional materials for various traditional ceramic applications
CO2 To have the ability to know about the concepts of glass and glass ceramics
CO3 To apply the concepts of advanced ceramic materials in various applications
CO4 To be familiar with the underlying concepts of functional ceramic materials
CO5 To have gained knowledge on the materials used for biological applications

TEXT BOOKS

REFERENCE BOOKS
2. Wolfram Holand and George Beall, “Glass Ceramic Technology”, The American Ceramic Society, 2002

CT5692 PROCESSING OF CERAMICS

COURSE OBJECTIVES
On completion of the course the students are expected to
- Have a thorough knowledge on the preparation of ceramic powder by mechanical and chemical methods.
- Have studied the types & role of additives in various ceramic forming processes.
- Have a better understanding on the mechanisms of sintering and grain growth during sintering.
Have learnt the advanced processing and sintering.
Have learnt about ceramic machining methods.

UNIT I          POWDER PREPARATION
Powder preparation by mechanical methods – comminution, mechano-chemical synthesis. Powder
synthesis by chemical methods – solid state reaction, liquid solutions, vapour phase reactions.

UNIT II         ADDITIVES
Types of additives in ceramic forming – solvents, dispersant, binder, plasticizer, other additives.
Effect/role of additive in ceramic forming - density, fluidity, viscosity, deflocculation, pH, zeta
potential, plasticity.

UNIT III        FORMING METHODS
Wet forming – Plaster mould, slip casting, pressure casting, gel casting, tape casting,
electrophoretic deposition. Plastic forming methods - injection molding. Dry forming - Uniaxial
pressing –vibration compaction, isostatic pressing.

UNIT IV         SINTERING
Definition, types of sintering – solid state sintering, liquid phase sintering; grain growth – different
grain growth process and control of grain growth. Advanced sintering – pressure assisted
sintering, reaction bonded sintering and microwave sintering.

UNIT V          MACHINING OF CERAMICS
Basic machining requirements of ceramics – Grinding – Ductile Mode – ELID Grinding, Zirconia,
Aluminium nitride – LASER assisted grinding – Ultrasonic machining – Abrasive water jet
machining – High energy beam machining – EB, IB. Surface finishing methods – Ultrasonic
lapping, MRAF.

TOTAL : 45 PERIODS

COURSE OUTCOMES
On completion of this Course, Students are expected to
CO1 Evaluate suitable method for ceramic powder preparation
CO2 Identify suitable Additives for Wet Processing
CO3 Identify suitable Wet, dry forming methods
CO4 Identify suitable temperature range, Sintering aid and other Physical
Parameters for sintering process
CO5 Identify suitable machining method for ceramic materials

TEXT BOOKS

REFERENCE BOOKS
4. Paul De Garmo E, Black J.J and Ronald A. Kohser, Materials and Processes in Manufacturing,
6. John G.P. Binner (Ed), Advanced Ceramics Processing and Technology, Noyes Publications,
7. Burtrand Lee and Sridhar Komarnej (Eds.), Chemical Processing of Ceramics, 2nd Edn.,
Taylor & Francis, 2005.
8. Loan D. Marinescu, Toshiro Doi, Eckart Uhlmann, Handbook of Ceramics Grinding and
OBJECTIVES
- To impart basic concepts of cancer biology and various stages in carcinogenesis.
- To gain insight on cancer metastasis and its molecular mechanism.
- To understand cancer prognosis.

UNIT I  CELL STRUCTURE, FUNCTION AND DIVISION  9
Cell organization, structure of organelles, extra cellular matrix and cell junctions. Cell cycle – mitosis, meiosis, cell cycle regulation and apoptosis.

UNIT II  INTRODUCTION TO CANCER  9
Definition, causes, cancer types and stages, hallmarks of cancer, modulation of cell cycle in cancer, carcinogenesis – initiation, promotion and progression, carcinogen and its types, diet and cancer.

UNIT III  CANCER PROGRESSION  9
Benign and malignant tumors, progress towards metastatic cancer, metastatic cascade and tumor cell invasion, angiogenesis.

UNIT IV  CANCER GENES AND SIGNAL TRANSDUCTION  9
Activation of kinases, oncogenes/proto-oncogenes activity, retrovirus and oncogenes, tumor suppressor genes and growth factors related to transformation.

UNIT V  CANCER DETECTION AND THERAPEUTICS  9

TOTAL : 45 PERIODS

OUTCOMES
- To create an awareness about cell structure and cell cycle regulation
- To make the students aware of what is cancer and how changes in cell cycle can trigger carcinogenesis
- To create an understanding of the cancer microenvironment and its influence on the human system
- To have an idea about potential carcinogens and the triggers involved
- To have understanding on medical applications for cancer

TEXT BOOKS

REFERENCES
UNIT I INTRODUCTION TO BIOTECHNOLOGY & IT'S SCOPE
Definition of biotechnology, mile stones in biotechnology – Who can be a biotechnologist? Applications of biotechnology in interdisciplinary (Mathematics, Chemistry, Microbiology, Aquaculture etc) and engineering (Fermentation Technology, Electronics, Plastic Technology etc) specialties, Future prospects of biotechnology industries – GM crops, animals, microbes, etc.

UNIT II PROTEINS AS PRODUCTS

UNIT III DNA, GENES, GENOMES & RDNA TECHNOLOGY
DNA: Structure – Gene: One gene one Enzyme concept, One Gene many enzymes concept, one gene many polypeptides concept, Genomes, what is genomics? – Transgenic animals and their applications, DNA Vaccines, Edible vaccines, what is recombinant DNA Technology? – A Case study

UNIT IV MEDICAL BIOTECHNOLOGY
Gene testing – identification of protein and genetic disorders, Gene screening – a tool for phenotypic screening e.g., Cancer identification & Gene therapy e.g., Cystic Fibrosis as a case study, Transgenic Pigs as an artificial organ donor

UNIT V DNA FINGERPRINTING, FORENSIC SCIENCE & ETHICS IN BIOTECHNOLOGY
Case study – Homicide, Disputed parentage, Immigration issues, Ethics in Biotechnology – GM crops – Ethical issues; Golden Rice – Eradication of Blindness

TOTAL: 45 PERIODS

OUTCOMES
- to make the students aware of the basic principles of biotechnology
- to be aware of the various techniques in biotechnology
- to make the students aware of the applications of biotechnology in the field of pharmaceuticals and medicine
- to make the students understand the importance of biotechnological techniques in the detections and early intervention against diseases
- to make the students aware of the prospects of biotechnology in crime detection and also make them aware of the ethic and regulations involved

TEXT BOOKS

REFERENCES

FT5691 BIOMOLECULES L T P C
3 0 0 3

COURSE OBJECTIVE
- To learn about the chemistry and structures of biomolecules
- To know the properties of different biomolecules
- To know the physiological functions of biomolecules
UNIT I  BASICS OF BIOMOLECULES
Introduction to Organic Biochemistry, History, Role of Berzelius Wohler, formation of urea. Structure of carbon compounds, valence electrons covalent bonds, electron dot formula. Tetrahedral structure, structural formula, empirical formula, molecular formula, condensed structural formula, Isomers, Homologus series and functional groups

UNIT II  CARBOHYDRATES
Classification of carbohydrates – Monosaccharides, General terminology, stereoisomerism, Steriochemistry cyclic forms of sugars, muta-rotation, Important of Monosaccharides (Glucose, fructose, galactose, mannose) & Disaccharides (Sucrose, Maltose), glycosidic bond, reducing sugars, classification of polysaccharides-Homo & Hetero polysaccharides. Glycans, glysaminoglycans, glycoproteins.

UNIT III  LIPIDS
Classification of Lipids, simple lipids, fatty acids, physical properties of lipids, chemical properties of lipids, waxes, compound lipids, phospholipids, sphingolipids, cholesterol, steroid hormones and prostaglandins hypercholesterolemia and cardiovascular disease, statins as Cholesterol reducing drugs, lipoproteins.

UNIT IV  PROTEINS
Classifications and functions of proteins, Amino acid structures, general properties of amino acids, peptide bonds, primary, secondary, tertiary and Quaternary structures of proteins. Properties of proteins, electrochemical properties, denaturation, nutritive value of proteins compared to fats and carbohydrates.

UNIT V  NUCLEIC ACIDS
Structure of nucleic acids, deoxyribo nucleicacid (DNA), Experimental that DNA was hereditary material, Chargaff’s rule, structure of DNA – Watson crick, RNA types - mRNA, tRNA, and rRNA. Genetic code. Recombinant DNA and its technology.

TOTAL: 45 PERIODS

COURSE OUTCOMES
At the end of the course the students will be able to,
- CO1: have a strong foundation in the structure and reactions of biomolecules.
- CO2: have in depth knowledge on classification, properties of carbohydrates.
- CO3: have in depth knowledge on classification, properties and functions of lipids.
- CO4: have in depth knowledge on classification, and functions of proteins.
- CO5: have in depth knowledge on structure of Nucleic acid and rDNA.

TEXT BOOKS:

REFERENCES:

52
OBJECTIVES:
- To introduce the basic concepts of Environment and pollutants and its pathways.
- To impart knowledge on the industrial pollutants from various sources
- To inculcate sound understanding of radioactive and hazardous pollutants

UNIT I  HUMAN INTERACTIONS WITH ENVIRONMENT
Relationship between human activity and environment- Types of Pollutants- Characteristics- Pathways of pollution-Emission and exposure pathways - Transport pathways for persistent and non-persistent pollutants in air, water and soil.

UNIT II  INDUSTRIAL CHEMICALS, AGRICULTURAL PESTICIDES AND CHEMICAL FERTILIZERS
Introduction- Hazardous properties- Sources- Environmental pathways- Human health- Risk reduction and future trends- Pesticides – Fertilizers- Risk reduction for pesticides and chemical fertilizers-

UNIT III  AIRBORNE PARTICLES
Introduction - Hazardous properties - Sources - Global pathways - Health effects of inhaled particulate material- Risk reduction and future trends-

UNIT IV  PHARMACEUTICALS, PERSONAL-CARE PRODUCTS AND ENGINEERED NANOMATERIALS
Introduction- Useful and hazardous properties- Anthropogenic sources – Sources of nanoparticles- Pathways and environmental fate- Physiological effects- Risk assessment- Regulations and reduction- Future trends

UNIT V  TRACE ELEMENTS, TOXIC TRACE ELEMENTS, RADIOACTIVITY AND RADIO ELEMENTS
Introduction - Hazardous properties - Sources - Environmental pathways- Effects on human receptors- Risk reduction- S-R-P model.

TOTAL : 45 PERIODS

OUTCOMES:
On the completion of the course students are expected to
CO1: Describe the routes of transport by which a pollutant travel from its source to human populations
CO 2: Understand the pollutants and its pathways
CO 3: Formulate risk assessment on various pollutants
CO 4: Analyze different Pollutant types and its toxicity to the environment
CO 5: Perform regulation and reduction models for future.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
The course content has been structured to help the student to gain an understanding of the principles of nanotechnology and its application in various fields.

UNIT I NANOTECHNOLOGY BACKGROUND
Scientific revolution- Atomic Structures-Molecular and atomic Size-Bohr radius – Emergence of Nanotechnology – Challenges in Nanotechnology - Carbon age–New form of carbon (from Graphene sheet toCNT).

UNIT II TYPES OF NANOMATERIALS

UNIT III SYNTHEIS OF NANOMATERIALS
Preparation of nanoscale metal oxides, metals, CNT, functionalized nanoporous adsorbents, nanocomposite- Chemical vapor deposition, sol-gel, sonochemical, microwave, solvothermal, plasma, pulsed laser ablation, magnetron sputtering, electrospinning, Molecular Condensation-Green synthesis.

UNIT IV NANOMATERIALS CHARACTERIZATION AND PROPERTIES
SEM, TEM, XRD, ESCA, IR & Raman, UV-DRS, of nanomaterials for structural & chemical nature, Size-dependent properties - Mechanical, Physical and Chemical properties.

UNIT V APPLICATIONS OF NANOMATERIALS
Nanomaterials as adsorbents for wastewater treatment – biofuels and bioenergy application – drug delivery – biomedical-biosensor -Nanomaterials for data storage –food-biological application- Environmental applications

TOTAL:45 PERIODS

OUTCOMES:
On the completion of the course, students are expected to
CO1: To know the nanomaterial synthesis methodology.
CO2: To know the classification of nanomaterials.
CO3: To know the recent application of nanomaterials in various fields.
CO4: To cultivate interest in the research and development of nanotechnology for future advancement of the career.
CO5: To gain a sense of critical thinking about carrying out research in the field of Nanotechnology

TEXTBOOKS:

REFERENCES
1. C.S.S.R.Kumar, J.Hormes, C.Leuschner, Nanofabrication towards biomedical applications,
OBJECTIVES
To impart detailed knowledge on petroleum refining upstream & downstream operations and to get awareness on the importance of plant safety and risk analysis in petroleum industries.

UNIT I INTRODUCTION TO SOURCE ROCKS AND CLASSIFICATION 9
Definition of source rock, Characteristics of Reservoir rocks, Reservoir pore space, porosity- primary and secondary porosity, effective porosity, fracture porosity - permeability – effective and relative permeability relationship between porosity, permeability and texture, Entrapment and accumulation of hydrocarbons, Sedimentary basins -origin and classification.

UNIT II PETROLEUM EXPLORATION 9
Overview of petroleum exploration in India, Introduction to Geophysical/Geological methods used in petroleum exploration. Basic concepts of Gravity/Magnetic methods, seismic methods.

UNIT III OIL RECOVERY TECHNIQUE 9
Calculation of hydrocarbon volumes, Material balance applied to oil reservoirs, Reservoir drive mechanism- Solution gas drive- Gas cap drive- Natural water Drive- Compaction drives under related pore compressibility phenomena. Oil Recovery Techniques.

UNIT IV PETROLEUM REFINING 9
Overall refinery operations & Indian scenario, Crude oil classification, Petroleum Products and their specifications, Atmospheric and Vacuum distillation units, Reforming, cracking and hydro treating processes.

UNIT V HEALTH AND SAFETY 9
Introduction to environmental control in the petroleum industry, Guidelines for occupational health monitoring in oil and gas industry. Hazard identification- Hazard evaluation- Classification of fires -The fire triangle- Distinction between fires and explosions- Flammability characteristics of liquids and vapors- Well blowout fires and their control- Fire fight equipment- Suppression of hydrocarbons fires.

TOTAL : 45 PERIODS

OUTCOMES:
CO1: To learn the types of petroleum source rocks and classification
CO2: To learn the exploring methods of crude,
CO3: To know the different oil recovery techniques
CO4: To learn basic refinery operations
CO5: To understand the importance of environmental aspects and safety measures

TEXT BOOKS :

REFERENCES :
OBJECTIVE:
- To understand the origin, exploration and testing of petroleum crude and its products
- To know about petroleum purification and refining process
- To acquire knowledge about the aliphatic and aromatic products from the hydrocarbon crude and its various uses
- To study about the various petrochemicals and their processing in industries
- To learn the production of second and third generation petrochemicals

UNIT I INTRODUCTION TO HYDROCARBONS 9
Origin and formation of petroleum; identification and exploration of reservoir; petroleum reservoir in the world; Evaluation of petroleum crude: physical properties and testing methods of crude and petroleum products.

UNIT II HYDROCARBON CRUDE PROCESSING 9
Primary Refining: dehydration and desalination of crudes, distillation (ADU & VDU) of petroleum. Thermal and Catalytic processes: Thermal and catalytic cracking processes; Coking and Air Blowing of Bitumen; Solvent extraction; hydro treatment processes; polymerization; isomerisation; Purification Process: Dewaxing, Clay Treatment and Hydrofining.

UNIT III PETROLEUM PRODUCTS EXTRACTION 9
Aliphatic and Aromatics derived from thermal cracking of naphtha, pyrolysis gasoline hydrogenation process. Utilization of aromatics; Separation of BTX from Reformate and its isolation; Alkylation of benzene; production of phthalic anhydride

UNIT IV INTRODUCTION TO PETROCHEMICALS 9
Introduction to petrochemicals: feed stocks survey of petrochemical industry. Resources and generation of different feed stocks-their purification, separation of individual components by adsorption, low temperature fractionation and crystallization.

UNIT V SECOND AND THIRD GENERATION OF PETROCHEMICALS MANUFACTURING 9
Production of Petrochemicals like Dimethyl Terephthalate (DMT), Ethylene Glycol, Synthetic Glycerine, Linear Alkyl Benzene (LAB), Acrylonitrile, Methyl Methacrylate (MMA), Vinyl Acetate Monomer, Phthalic Anhydride, Maleic Anhydride, Phenol and Acetone, Methanol, Formaldehyde, Acetaldehyde, Pentaerythritol and Production of Carbon Black

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On successful completion of this course, the students will be able to
CO1: Learn about the formation, exploration of hydrocarbon and analysing the physical properties
CO2: Gain the knowledge behind primary refining process and purification of Hydrocarbon
CO3: Understand the concept about the primary generation of petrochemicals and its production method
CO4: Impart the knowledge about petrochemical industries and their feed stock processing
CO5: Know the manufacturing process of some petrochemicals and their applications

TEXT BOOKS
REFERENCE BOOK
2. SrikumarKoyikkal, “Chemical Process Technology and Simulation”, PHI Learning Ltd

AS5692 LIFESTYLE MODIFICATIONS AND HEALTH IN UNISON L T P C

OBJECTIVES
The course is aimed to
  - To Understand Glycemic index value and importance of millet foods
  - To Know the important values for immunization scheduling and avoiding cervical cancer
  - To Impart the knowledge about ORS
  - To Gain the knowledge about HDL and LDL cholesterol and Thyroid stimulating hormone
  - To create an awareness about pollution and hazards among students

UNIT I IMPORTANCE OF MICRONUTRIENTS AND ADHERING TO LOW GLYCEMIC INDEX FOODS 10

UNIT II IMMUNIZATION SCHEDULING – NEED FOR ADHERENCE  9
Protein calorie malnutrition –Importance of intake of folic acid supplements to prevent genital abnormalities –Necessity to avoid early marriage –Need for various immunizations their dosage schedules-Need to immunize adolescent girl children to prevent cervical cancer.

UNIT III LIFE SAVING CHILD SURVIVAL STRATEGIES  8
Drastically cutting down mortality and morbidity –Causative factors of dehydration –Warning symptoms - Need to administer lifesaving Oral Rehydration Salt solution (ORS) Methodology of preparing ORS solution-Importance of zinc as an additive.

UNIT IV STRATEGIES FOR INCREASING HDL AND LOWERING LDL CHOLESTEROL  9
Healthy fats –Need to avoid saturated and trans fats - Optimum value of HDL and LDL cholesterol –Need to lower triglycerides - Ways of reducing bad LDL cholesterol –Role of Thyroid Simulating Hormone (TSH) - Importance of mental health –Positive and optimistic outlook on life – Panic breathing as a stress relief mechanism.

UNIT V DRINKING WATER STANDARDS  9

COURSE OUTCOMES
On completion of the course students are expected to
CO1: Get the knowledge about Glycemic index value and regular usage of millet foods in our daily life.
CO2: Know the necessity of regular immunization from birth and to avoid cervical cancer in girls
CO3: Learn the preparative methodology and advantages of lifesaving OR solution
CO4: Understand about the bad cholesterol and ways of reducing it and about TSH
CO5: Apply their Knowledge in day today life to avoid pollution.

TOTAL: 45 PERIODS
TEXT BOOK

REFERENCES
2. Relieve Your Health Issues By The Change: Lifestyle Modifications for More Control of Common Health Issues in Addition to Medications, by Alaa George
4. Internet Addiction and Lifestyle Modificationsby Farzana BegumScholars’ Press, 2019

AS5693 PETROLEUM OPERATIONS

OBJECTIVE:
- To provide an overview of petroleum industry.
- Petroleum exploration and exploitation techniques, oil and gas reserve identification and evaluation.
- Drilling and production of oil and gas.
- Understand the latest trends in the petroleum industry

UNIT I RESERVOIR GEOLOGY

UNIT II WELL DRILLING
Drilling – introduction to drilling of oil and gas wells. Drilling rigs and equipment’s. Well planning, Rig operating systems, drilling fluids and cementing - functions & properties, drill bit types & their applications, drill string, drilling problems- their control & remedies.

UNIT III FORMATION EVALUATION

UNIT IV PRODUCTION OPTIMIZATION
Petroleum exploitation – Well testing, production potential and well performances. Petroleum production system, formation damage, well stimulation techniques, artificial lift techniques, Nodal system analysis.

UNIT V RECOVERY METHODS AND LATEST TRENDS
Basic principle & mechanism of EOR, Screening of EOR process, recovery efficiency, permeability heterogeneity, EOR methods: chemical flooding, thermal recoveries (steam stimulation, steam flooding, ISC), microbial EOR Latest trends – Coal Bed Methane, Shale gas, Oil shale, gas hydrate, heavy oil.

TOTAL: 45 PERIODS

COURSE OUTCOMES
On completion of the course students are expected to
CO1: Understand the concept of accumulation and formation of crude oil
CO2: Apply the concepts related to exploration and development of reservoir through drilling
CO3: Apply the concepts evaluating the reservoir through formation evaluation
CO4: Understanding process of production optimization from the reservoir
CO5: Identify the various recovery methods and latest trends in the petroleum industry

TEXT BOOK:

REFERENCES:

PH5691 ELECTROMAGNETIC THEORY L T P C 3 0 0 3

OBJECTIVE
1. To learn the electromagnetic theory due to the fields produced by stationary and moving charges and propagation of fields

UNIT I ELECTROSTATICS AND POLARIZATION 9
Gauss’s law – Field due to an infinite, straight, uniformly charged wire – Multipole expansion of a charge distribution -- Field inside a uniformly polarized sphere – Electric field inside a dielectric – Electric displacement and polarizability – Claussius-Mossotti relation – Polarization of polar molecules and Langevin equation and Debye relation – Electrostatic energy.

UNIT II BOUNDARY VALUE PROBLEMS IN ELECTROSTATICS 9
Boundary conditions – Potential at a point between the plates of a spherical capacitor – Potential at a point due to uniformly charged disc – Method of image charges – Point charge in the presence of a grounded conducting sphere -- Point charge in the presence of a charged, insulated conducting sphere -- Conducting sphere in a uniform electric field– Laplace equation in rectangular coordinates.

UNIT III MAGNETOSTATICS 9
Magnetic scalar and vector potentials – Magnetic dipole in a uniform field – Magnetization current – Magnetic intensity – Magnetic susceptibility and permeability – Hysteresis –Correspondences in electrostatics and magnetostatics.

UNIT IV FIELD EQUATIONS AND CONSERVATION LAWS 9

UNIT V ELECTROMAGNETIC WAVES AND WAVE PROPAGATION 9

TOTAL: 45 PERIODS
OUTCOMES
At the end of the course, the students will be able to
- understand the electrostatics and polarization principles
- acquire knowledge on boundary value problems, physics of charges and electric fields
- get knowledge on magnetostatics, hysteresis and correspondence between electro- and magnetostatics
- have the necessary understanding on filed equations and conservation laws
- gain knowledge on principles of electromagnetic wave propagation and its applications in waveguides.

REFERENCES

PH5692 PHYSICS OF SEMICONDUCTOR DEVICES L T P C
3 0 0 3

OBJECTIVE
- To learn the physics principles behind the operation of some important semiconductor devices.

UNIT I PROPERTIES OF SEMICONDUCTORS 9
Crystal structure - reciprocal lattice - Brillouin zone and rules for band (k - space) representation. Dynamics of electrons in periodic potential: Kronig - Penny and nearly free electron models - Real methods for band structure calculations; Bandgaps in semiconductors - Holes and effective mass concept - Properties of conduction and valence bands – semiconductor defects - lattice mismatched structures – strained epitaxy.

UNIT II ELECTRONIC LEVELS IN SEMICONDUCTORS 9

UNIT III CHARGE TRANSPORT 9

UNIT IV OPTICAL TRANSPORT 9

UNIT V SEMICONDUCTOR DEVICES 9
and 3D photonic crystals. Active and passive optoelectronic devices: performance and response enhancement

TOTAL : 45 PERIODS

OUTCOMES
At the end of the course, the students will be able to

- gain knowledge on various crystal structures, energy bands and semiconductor defects
- acquire knowledge on the basics of electronic energy levels, carrier concentration and tuned electronic properties
- get knowledge on carrier transport mechanisms
- have the necessary understanding on the concepts of optical transport mechanisms
- have adequate knowledge on different functional semiconductor devices

REFERENCES

PH5693 NANO-SCALE MATERIALS AND APPLICATIONS

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OBJECTIVE
- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION
Definition of Nano, Scientific revolution-Atomic Structure and atomic size, Size effect , 3D, 2D, 1D and zero dimensional structures- Quantum confinement of electrons in semiconductor nanostructures- Quantum dots - nano wires- Nanotubes - Single walled and Multi walled Nanotubes (SWNT and MWNT) – nanofibers.

UNIT II PROPERTIES
Length Scales involved and size effect on properties: Mechanical, Electrical, Electronic, Optical, Thermal and Magnetic properties; Gaint magnetoresistance, Tunneling magnetoresistance, Colossal magnetoresistance, Superparamagnetism, Superconducting nano-materials & their properties and applications.

UNIT III SYNTHESIS

UNIT IV APPLICATIONS
Biological and environmental, membrane based applications, polymer based application, Molecular electronics and nanoelectronics Single electron transistors, nanoparticles based solar cells and quantum dots based white LEDs and lasers–CNT based transistors, Nanoscale electronic devices including CMOS, Potentiometric sensors etc., MRAM devices, Spintronic devices including spin valves

UNIT V RECENT DEVELOPMENT
Nanopolymers- polymer based nanocomposites, Nanoparticles polymer ensembles- Applications, Nanocomposites - Metal-Metal nanocomposites, Polymer-Metal nanocomposites, Ceramic nanocomposites, Dielectric and CMR based nanocomposites,
OUTCOMES
Upon completing this course, the students will
- familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in the technological applications of the nanomaterial

REFERENCES

PH5694 QUANTUM PHYSICS FOR ENGINEERS

OBJECTIVE
- To make the students to understand the basics of quantum mechanics.
- To equip the students with the knowledge of statistical quantum mechanics.
- To elucidate the importance of single quantum systems.
- To make the students to understand the principles of particles in simple potentials.
- To make the students to understand the working of nano-devices.

UNIT I QUANTUM MECHANICS

UNIT II STATISTICAL MECHANICS

UNIT III SINGLE QUANTUM SYSTEMS

UNIT IV PARTICLES IN SIMPLE POTENTIALS
UNIT V  NANOSCALE PHYSICS AND DEVICES


TOTAL: 45 PERIODS

OUTCOMES
After completion of this course, the students should able to
- Understand the basics of quantum mechanics.
- Use the knowledge of statistical quantum mechanics.
- Understand the importance of single quantum systems.
- Know thenature of particles in different potentials.
- Understand the working principles of different nano-devices.

REFERENCES

HS5691  ENGLISH FOR COMPETITIVE EXAMINATIONS  L T P C
3 0 0 3

Course Description:
Students aspiring to take up competitive exams of which the English language is a vital component will find this course useful. Designed for students in the higher semesters, the course will help students to familiarise themselves with those aspects of English that are tested in these examinations.

Objectives:
- To train the students in the language components essential to face competitive examinations both at the national (UPSC, Banking, Railway, Defence) and the international level (GRE, TOEFL, IELTS).
- To enhance an awareness of the specific patterns in language testing and the respective skills to tackle verbal reasoning and verbal ability tests.
- To inculcate effective practices in language-learning in order to improve accuracy in usage of grammar and coherence in writing.

UNIT I

UNIT II

UNIT III
UNIT IV

UNIT V

Teaching Methods:
Instructional methods will involve discussions, taking mock tests on various question papers – Objective, multiple-choice and descriptive. Peer evaluation, self-check on improvement and peer feedback - Practice sessions on speaking assessments, interview and discussion – Using multimedia.

Evaluative Pattern:
- Internal Tests – 50%
- End Semester Exam - 50%

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to
- expand their vocabulary and gain practical techniques to read and comprehend a wide range of texts with the emphasis required
- identify errors with precision and write with clarity and coherence
- understand the importance of task fulfilment and the usage of task-appropriate vocabulary.

TEXT BOOK:

REFERENCE BOOK

Websites

Course Description
This course is designed to teach creative and critical thinking, language and communication skills and problem solving skills through science fiction. Science fiction and allied science writings are used as materials to generate discussions on language, ideas, problems and solutions.
Objectives
- To familiarize students with the genre of science fiction.
- To help students appreciate the nuances of the language used in science fiction.
- To provide students with the material to discuss common themes of human concern as perceived by science fiction writers.
- To help students speak and write critically about common human problems and solutions.
- To encourage students to write creatively about futuristic contexts.

UNIT I SCIENCE FICTION – AN INTRODUCTION
Definition of the genre - The beginnings of the genre - Gothic fiction and fantasy - Early writers - Science as a reflection of the spirit of scientific enquiry of the time, Science fiction as a forerunner of future developments in science
Text for study: H.G.Wells’ Time machine

UNIT II SOCIAL SCIENCE FICTION
Use of science fiction to criticize contemporary world and predict the future - Utopian vs dystopian fiction
Text for study: George Orwell’s 1984

UNIT III MAN AND MACHINE
Exploration of the relationship between man, machine and morality - Man vs machine, Artificial intelligence
Text for study: ‘Robby’ from Isaac Asimov’s I, Robot

UNIT IV OTHER WORLDS
Exploring the idea of aliens and other worlds – Space colonization
Text for study: Mars is Heaven by Ray Bradbury

UNIT V BIOLOGICAL SCIENCES
Exploring the forays into biological research - Dangers and ethical issues in cloning
Text for study: Barney by Will Stanton

TOTAL: 45 PERIODS

LEARNING OUTCOMES
By the end of the course students will be able to
- read and understand science fiction texts and the literary tools and strategies used by writers to communicate their meaning.
- collect, organize and present details about the writers, the historical and general contexts of the texts.
- discuss, analyse and argue about issues related to science and technology and their impact on society, culture, war, race, gender and the like.
- write critically and analytically about common social problems.
- speak and write imaginatively about futuristic contexts.

REFERENCES
2. Prucher, Jeffrey (ed) Brave new words: the Oxford dictionary of science fiction, USA: OUP, 2006
5. http://www.sfhub.ac.uk/

HS5693 BUSINESS COMMUNICATION FOR ENTREPRENEURS

Course Description
This course is designed to help students who have entrepreneurial ambitions to communicate their business ideas both in formal and informal contexts using both the spoken and the written medium. It aims to teach them to create effective business documents and use group / team communication.
Course Objectives

- To enable learners to communicate effectively in a business environment.
- To familiarize learners with 21st century skills in global workplace contexts.
- To present their ideas and opinions clearly and effectively in both spoken and written communication.
- To create clear, concise and concrete business documents.
- To evaluate their target audience and make appropriate choices of communication methods.

UNIT I  INTRODUCTION TO BUSINESS COMMUNICATION 9
The business context – Communication needs – Barriers to Communication - Self-introduction – Taking part in conversations – listening - making small talk – business writing –Memos, Circulars, Notices – reading and understanding business documents

UNIT II  TELEPHONE / EMAIL COMMUNICATION 9
Listening and responding in formal telephone conversation – Spoken and written messages - Cross cultural communication – reading business letters /emails – writing business letters / emails – Good news and bad news letters / emails, complaint and enquiry letters / emails

UNIT III  INTERPERSONAL AND GROUP COMMUNICATION 9
Meetings and making notes – Writing minutes for a meeting – reading and interpreting business articles - taking part in group discussion – GD etiquette – expressing opinions - persuasive communication – negotiation – conflict and consensus

UNIT IV  BUSINESS PRESENTATIONS 9
Company profile – job advertisements – job application – Resume writing – facing an interview – making a presentation – planning a business pitch – gauging the target audience - using graphical material

UNIT V  BUSINESS REPORTS 9

TOTAL: 45 PERIODS

Learning Outcomes
At the end of the course students will be able to
- read and comprehend business related documents
- write different business related documents clearly
- express ideas and views precisely and convincingly
- make persuasive presentations using visual aids
- collect business data and present it in a business report

REFERENCES
COURSE OBJECTIVES:

- To learn the state of art of vitamins and minerals and their role in human nutrition
- To appreciate the difference in proteins and carbohydrates and their importance
- To identify the fats and oils and the analysis of the same
- To impart basic knowledge in methodology and diagnostics within Clinical Chemistry
- To understand the working principle of the diagnostic medical devices and spectroscopic equipment

UNIT I VITAMINS AND MINERALS 9
Vitamins - definition, types – fat soluble and oil soluble vitamins, sources and deficiency diseases - Minerals - types, sources and deficiency diseases - the function and role of vitamins and minerals - metabolism of vitamins and minerals.

UNIT II PROTEINS AND CARBOHYDRATES 9
Proteins - definition, sources - classification – aminoacids – essential and non essential aminoacids - structure and functions of proteins – Carbohydrates: sources – classification (mono, di and poly) - structure and functions of carbohydrates - Qualitative and quantitative tests for proteins and carbohydrates.

UNIT III OILS AND FATS 9
Edible and non edible oils - Extraction and processing of oils and fats - Oils and fats as food materials and their Rancidity process, tests for rancidity - Hydrogenation of oils - analysis of fats and oils - Flow test, cloud test, consistency test, penetration method, saponification value, acid value and free fatty acid.

UNIT IV CLINICAL CHEMISTRY 9
Estimation of glucose, electrolytes, T3, T4, and TSH, Thyroid peroxidase (TPO) antibodies, LDH, phosphatases, amylase, creatine, proteins – Its effect on health - Clinical significance of pH and blood gas parameters: pH, PCO₂, PO₂, bicarbonate, carbonic acid, excess base, oxygen saturation, fractional oxyhemoglobin, hemoglobin oxygen (binding) capacity, oxygen content and total CO₂.

UNIT V DIAGNOSTIC MEDICAL DEVICES 9
Commonly used diagnostic tools: Thermometer, Stethoscopes, Sphygmomanometers, Ophthalmoscopes, Otoscopes, Electrocardiographs - Principles and instrumentation of spectrophotometry, potentiometry, electrophoresis, immunoassay, and chromatography.

COURSE OUTCOMES:
The student will be able to

- understand the basis of the interactions with food and medicines
- familiar with common healthy diets required for a human being
- comprehend vitamins and minerals supplementation and fortification
- attain knowledge about the processing technologies of fats and oils
- critically evaluate the diverse technologies and the consequent chemical and physico-chemical modifications on oils and fats
- gain knowledge on the various diagnostic tools and spectroscopic equipments

TOTAL: 45 PERIODS

REFERENCES:

CY5692 CHEMISTRY IN EVERYDAY LIFE L T P C

OBJECTIVES:
- To understand the role of cosmetics.
- To acquire knowledge about the cleaning products.
- To enable students to understand the importance of kitchen chemistry
- To learn about the chemistry involved in pharmacy.
- To gain knowledge in the field of dyes and pigments.

UNIT I COSMETICS 9

UNIT II CLEANING PRODUCTS 9
Floor cleaners and their types, Dish washing liquids and powders, toilet cleaners, hand wash, hand sanitizer, detergents, stain remover.

UNIT III KITCHEN CHEMISTRY 9
Proteins, fats – definition and their importance as food constituents. Balanced diet – calorie – minerals and vitamins (sources and their importance) – Food additives and their ill effects.

UNIT IV PHARMACEUTICAL CHEMISTRY 9

UNIT V DYES AND PIGMENTS 9
Pigments and dyes – examples and applications, natural food colours and their health aspects, dyes in bioanalysis and medical diagnostics.

TOTAL: 45 PERIODS

OUTCOMES:
- Will be aware of cosmetics used in everyday life.
- Will be conversant with cleaning products used in households and industries.
- Will be familiar with the dietary importance of proteins, fats and minerals.
- Will acquire knowledge about analgesics, antipyretics, antibiotics and antifungals.
- Will understand the importance of dyes and pigments.

REFERENCES:
COURSE OBJECTIVES:

- To introduce the fundamentals of forensic chemistry and materials used.
- To teach the significance and procedures of analytical techniques such as separation, spectroscopic and chromatography in forensic analysis.
- To facilitate the understanding of fingerprint detection techniques in various surfaces and to understand the examination of papers and inks.
- To introduce the role and analysis of materials in crime investigation including fire and arson.
- To impart knowledge of the chemistry of drugs and poisons in forensic analysis.

UNIT I  FUNDAMENTALS OF FORENSIC CHEMISTRY  
Introduction: Definition of forensic Science, History and development, multidisciplinary nature, the role of the forensic laboratory. Introduction to Forensic Chemistry, branches of and cases involved in Forensic chemistry. Examples of materials in forensics: Organic (dyes, pigments, inks, fibers, drug, food and food additives), inorganic (metals and alloys, acids and bases, analytical reagents), biological substances (DNA and mitochondrial DNA, blood, hair, semen, saliva) and industrial products (polymers, glass, sugar, oils and fats, paints, cosmetics, petroleum, fertilizers, insecticides, explosives, liquor). Phenolphthalein in trap case: Chemistry and Forensic examination of Phenolphthalein used in bribe trap cases.

UNIT II  ANALYTICAL METHODS IN FORENSICS  
Nature and scope of analytical chemistry in forensic chemical analysis; Methods of sample preparation - Chemical separation Techniques: Solvent extraction (Liquid-liquid extraction), Solid phase extraction, Solid phase microextraction (SPME). Spectroscopic analysis: Analytical Protocols, Interpretation and Forensic applications of: Fluorescence, Phosphorescence and Chemiluminescence spectrometry, UV-Visible spectroscopy, FT-IR and AAS. Chromatography: Classification of chromatographic techniques, Basic Principle, Instrumentation and Forensic applications of HPTLC, Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC) and Pyrolysis gas Chromatography.

UNIT III  ANALYSIS OF FINGERPRINTS AND QUESTIONED DOCUMENTS  

UNIT IV  MATERIAL EVIDENCES  
Role of materials in crime investigation: Glass, paints, dyes and pigments, soil, fibers and textiles, tools and tool marks, gunshot residue, fertilisers, insecticides and biological samples; Adulteration in consumer items- oils and fats, food additives, cosmetics, gold, silver. Samples from fire and arson: Extraction of samples from debris (Direct and solvent extraction methods, Head Space method, SPME, Distillation), Clean-up (Filtration & Acid stripping) and Analysis (only application of GC, GC-MS, FTIR & SEM). Case studies: Students to present on investigation of crime through any two material evidence analysis.

UNIT V  DRUGS AND POISONS  
Drugs: Definition, Use & Misuse; Brain Chemistry: Drug Receptors, dependence and Addiction; Drugs of Abuse: Opium and Opioids analgesics, Stimulants (Cocaine, Amphetamine), Depressants (Barbiturates and Benzodiazepines), Hallucinogens (Cannabis, LSD, Psilocybine and Mescaline), OTC, Inhahltant and Volatile Substances. Poisons: Animal Poisons: Insects and animal toxins, snake venoms, tests for identification and effect on body; Plant poisons: Classification and characteristics, extraction and stripping from matrices, analysis by chemical and instrumental techniques. Gaseous Poisoning: CO, HCN and Phosphine gas - signs and symptoms, methods of diagnosis, tests for identification. Food
Poisoning: Food poisoning due to chemicals and bacteria, extraction, isolation, detection and identification by colour test and Instrumental techniques.

TOTAL: 45 PERIODS

COURSE OUTCOME:
At the end of the course the students will be able to:
- Identify the class of materials and their significance in forensic investigation.
- Apply chemical and sophisticated analysis towards forensic investigation.
- Recommend suitable identification method for fingerprint and document analysis.
- Identify and quantify the various evidence materials used in forensics.
- Use the knowledge of drugs and poisons for forensic examinations.

REFERENCES:
7. DFS Manuals of Forensic Chemistry and Narcotics, Directorate of forensic science services, Ministry of Home affairs, GOI, New Delhi.
UNIT I  
INTRODUCTION  
Fuel cell basics - Attractive features - Batteries and fuel cells – Principle and working of fuel cells - Types of fuel cells

UNIT II  
CLASSIFICATION OF FUEL CELLS  
Proton exchange membrane fuel cell (PEMFC) - Direct methanol fuel cell (DMFC) - Alkaline fuel cell (AFC) - Solid oxide fuel cells (SOFC) - Molten carbonate fuel cell (MCFC) – Bio fuel cell (BFC) – Enzymatic and Microbial

UNIT III  
THERMODYNAMICS AND KINETICS  
Basics of electrochemistry – Cyclic Voltammetry – Chronoamperometry – Chronocoulometry - Fuel cell thermodynamics - Efficiency of fuel cells - fuel cell electrochemistry - Nernst equation, Electrochemical Kinetics - Butler-Volmer equation

UNIT IV  
CONSTRUCTION AND WORKING OF FUEL CELLS  
Fuel cell design and components - Cell components, stack components, system components – Membrane electrode assembly (MEA) preparation - Fuel Cell Performance - Current density and Power density

UNIT  
APPLICATIONS OF FUEL CELLS  
Hydrogen as Green energy – Energy sectors – Automobile and other industries

TOTAL: 45 PERIODS

REFERENCES:

ME5695  
SUSTAINABLE ENERGY TECHNOLOGIES AND ASSESSMENT  
COURSE OBJECTIVES:
1. To study and understand the global and Indian energy scenario
2. To identify the energy demand and bridge the gap with suitable technology for sustainable habitat
3. To learn how to design and conduct performance analysis in various energy systems
4. To get familiar with the energy technology, current status of research and find the ways to optimize a system as per the user requirement
5. To impart basic knowledge related to numerical simulation analysis

UNIT I  
ENERGY SCENARIO STATUS AND POLICY  

UNIT II  
SOLAR THERMAL & PHOTO VOLTAIC TECHNOLOGY  
Solar radiation – Measurements of solar radiation and sunshine – Solar thermal collectors and applications – Principle of working, types, design and operation of solar heating and cooling systems
UNIT III WIND ENERGY, BIO ENERGY, OTEC & GEOTHERMAL ENERGY


UNIT IV ENERGY STORAGE TECHNOLOGIES

Necessity of energy storage – types of energy storage – comparison of energy storage technologies – Applications – Thermal storage types – Modelling of thermal storage units – Simple water and rock bed storage system – Fundamental concept of batteries & types, charging and discharging, storage & energy density and safety issues – Hydrogen storage – Flywheel, Super capacitors – Compressed air Energy storage & Concept of Hybrid Storage. TRYNSYS, PY SYST, TONATIUH, ANSYS & COMSOL.

UNIT V ENERGY: NODAL AGENCIES, RESEARCH CENTRES & GOVERNMENT SCHEMES


TOTAL: 45 PERIODS

REFERENCES:

OBJECTIVES:
1. To create awareness about modern healthcare machines
2. To understand the basic equipment/machines in Healthcare industry
3. To appreciate the application of Intelligent machines and applications of AI & ML in imaging
4. To recognise the role of maternal machines in future
5. To explain the role of Digital technologies in modern healthcare industry

UNIT I  INTRODUCTION

UNIT II  BASIC EQUIPMENT'S

UNIT III  INTELLIGENT IMAGING MACHINES

UNIT IV  MATERNAL MACHINES
CASA- Anaesthesia workstation- ICSI Equipments-Warmers- Incubation carestation- Resuscitation Systems-Phototherapy system - Fetal Monitors-Application of AI in Maternal Machines-Case studies

UNIT V  DIGITAL HEALTHCARE

OUTCOMES:
The students will able to
1. Remember the role modern healthcare machines
2. Ability to understand and Interpret the results from basic healthcare equipment’s
3. Appreciate the role of AI and ML in Medical Imaging
4. Understand the capability of Maternal Machines
5. Discover the role digital technologies in modern healthcare industry

REFERENCES:
5. Abdulmotaleb El Saddik, Digital Twins for Healthcare, Elsevier Science, 2022, 97803239916
COURSE OBJECTIVES:

- To understand the importance of various materials used in electrical, electronics and magnetic applications
- To acquire knowledge on the properties of electrical, electronics and magnetic materials.
- To gain knowledge on the selection of suitable materials for the given application
- To understand the fundamental concepts in Semiconducting materials
- To get equipped with the materials used in optical and optoelectronic applications.

UNIT I DIELECTRIC MATERIALS

Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT II MAGNETIC MATERIALS

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and Hysteresis

UNIT III SEMICONDUCTOR MATERIALS

Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques. concept of superconductivity; theories and examples for high temperature superconductivity; discussion on specific superconducting materials; comments on fabrication and engineering applications.

UNIT IV MATERIALS FOR ELECTRICAL APPLICATIONS

Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

UNIT V OPTICAL AND OPTOELECTRONIC MATERIALS


COURSE OUTCOMES:

After completion of this course, the students will be able to

- Understand various types of dielectric materials, their properties in various conditions.
- Evaluate magnetic materials and their behavior.
- Evaluate semiconductor materials and technologies.
- Select suitable materials for electrical engineering applications.
- Identify right material for optical and optoelectronic applications

TEXT BOOKS:

REFERENCES:

IE5692 INTRODUCTION TO APPLIED DATA ANALYTICS

OBJECTIVES:
- Learn the fundamental principles of analytics for business
- Visualize and explore data to better understand relationships among variables
- To understand the principles and techniques for data analysis
- Examine how analytics can be used in decision making Business Analytics.

UNIT I INTRODUCTION
Introduction to analytics: Driven Decision Making, Importance, Relationship with Organisational Decision Making, Analytics for Competitive Advantage, analytics types, applications- Models: predictive models - descriptive models - decision models - applications - analytical techniques

UNIT II UNDERSTANDING DATA
Data types and associated techniques – complexities of data – data preparation, pre-processing – exploratory data analysis

UNIT III DESCRIPTIVE ANALYTICS
Descriptive Statistical Measures- Probability Distributions and Data Modelling- Sampling and Estimation- Statistical Inference

UNIT IV PREDICTIVE ANALYTICS
Trend lines and Regression Analysis- Forecasting Techniques - Monte Carlo Simulation

UNIT V PRESCRIPTIVE ANALYTICS
Optimization- Decision trees- Heuristics methods.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Understand the importance of analytics
CO2: Able to prepare and process data for the models
CO3: Learn about statistical analysis techniques used in Data Analytics
CO4: Ability to model data and establish baseline performance
CO5: Build and apply analytics in a variety of business contexts

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TEXT BOOKS:
OBJECTIVE:
To inculcate in students awareness on global initiatives towards attaining sustainability.

UNIT I INTRODUCTION

UNIT II SUSTAINABLE DEVELOPMENT GOALS
Millennium Development Goals (MDGs), Sustainable Development Goals (SDGs), Clean Development Mechanism (CDM), Environmental Law and Sustainability

UNIT III SUSTAINABLE ENGINEERING THEORY AND CONCEPTS
Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Carbon credits, carbon trading and carbon foot print, Ecological and Other Footprints, Sustainability Indicators, Industrial Ecology, Green Chemistry and Engineering, Life Cycle Concept, Design for Environment, Ecodesign.

UNIT IV SUSTAINABILITY ASSESSMENT

UNIT IV SOLUTIONS FOR SUSTAINABILITY
Designing Sustainable Processes and Products, Industrial Symbiosis and the Circular Economy, Ecosystems in Engineering, Economic Policies, Societal Development

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After studying this course, students will be able to:
CO1: Understand various issues of sustainability
CO2: Get familiarity about Sustainable Development Goals (SDGs)
CO3: Understand and apply sustainability concepts in product developments and processes across various engineering disciplines.
CO4: Perform Sustainability Assessment
CO5: Provide Solutions for Sustainability

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TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES

- To impart knowledge on the principles of balancing social, economic and environmental dimensions for the development and the associated international and national frameworks.
- To enlighten the sustainable indices, associated models, legal aspects and their importance so as to quantify the sustainable development of a real time system.
- To inculcate the culture of societal development and policies for a sustainable environment, protection and balanced consumption of natural resources.
- To impart knowledge on the creation of manufactured products that use processes that are non-polluting, conserve energy and natural resources, and are economically sound and safe for employees, communities and consumers.
- To familiarise new concepts and trends in energy generation and conservation, green supply chain and entrepreneurial exploitation.

UNIT I SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL ISSUES 9

UNIT II SUSTAINABLE DEVELOPMENT INDICATORS 9

UNIT III SOCIAL DIMENSIONS 9

UNIT IV SUSTAINABLE MANUFACTURING 9

UNIT V ENERGY, ENVIRONMENT AND ECONOMICS OF SUSTAINABLE MANUFACTURING 9

TOTAL :45 PERIODS
COURSE OUTCOMES
Upon completion of this course, the students will:
CO1: Gain knowledge about various factors that drive sustainability and will approach all aspects of engineering with a sustaining insight.
CO2: Be aware of significance of various sustainable indices and legal aspects.
CO3: Understand the relationship between social, economic and environmental elements and will strive for sustainable development of systems.
CO4: Be disciplined to follow strong sustainable principles and develop environment friendly manufacturing methods and products.
CO5: Realize the need to conserve energy and natural resources, and to carry out manufacturing in a sustainable way.

TEXT BOOKS:

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