VIGNAN'S
Foundation for Science, Technology & Research
(Deemed to be UNIVERSITY)
-Estd. u/s 3 of UGC Act 1956

R22 Open Electives

List of R22 Open Elective Subjects Branch Wise

Course Code	Course Title	L	T	P	C	Course Offered
22BI851	Elements of Bioinformatics	2	0	2	3	BI
22BI852	Cheminformatics and QSAR	2	2	0	3	BI
22BI853	Computer-Aided Drug Design	2	0	2	3	BI
22BI854	Vaccine Design	2	0	2	3	BI
22BT853	Computational Biology	2	0	2	3	BI
22BM851	Basic Clinical Sciences	2	2	0	3	BME
22BM852	Biomedical Instrumentation	2	2	0	3	BME
22BM853	Diagnostic and Therapeutic Equipments	2	2	0	3	BME
22BM854	Medical Imaging Modalities	2	2	0	3	BME
22BM855	Biomaterials	2	2	0	3	BME
22BT851	Biology for Engineers	2	2	0	3	BT
22BT852	Bioplastics and Biocomposites	2	0	2	3	BT
22BT853	Computational Biology	2	0	2	3	BT
22BT854	Biosensors	2	2	0	3	BT
22CT851	Bioremediation Technologies for Environmental Pollutants	2	2	0	3	Chemistry
22CT852	Chemistry for Emerging Technologies	2	2	0	3	Chemistry
22CT853	Chemistry in Daily Life	2	2	0	3	Chemistry
22CT854	Computational Chemistry	2	0	2	3	Chemistry
22CT855	Electrochemical Energy Conversion and Storage	2	2	0	3	Chemistry
22CT856	Electronic and Optoelectronic Polymers	2	2	0	3	Chemistry
22CT857	Nanobiotechnology	2	2	0	3	Chemistry
22CT858	Nanoscience and Technology	2	2	0	3	Chemistry
22CT859	Organic and Nanomaterials for Electronic and Optical Properties	2	2	0	3	Chemistry
22CE851	Disaster Management	2	2	0	3	CIVIL
22CE852	Ecological Engineering	2	2	0	3	CIVIL
22CE853	Environmental Pollution & Control	2	2	0	3	CIVIL
22CE854	Remote Sensing & Geographical Information System	2	2	0	3	CIVIL
22CE855	Sanitary Engineering	2	2	0	3	CIVIL
22CE856	Solid Waste Management	2	2	0	3	CIVIL
22CS851	Database Systems	2	0	2	3	CSE
22CS852	Mobile Application Design and Development	2	0	2	3	CSE
22CS853	Java Programming	2	0	2	3	CSE

22CS854	Python Programming	2	0	2	3	CSE
22CS855	Design and Development of Internet Applications	2	0	2	3	CSE
22EC855	Android OS and Application Development	2	0	2	3	ECE
22EC856	Internet of Things	2	0	2	3	ECE
22EC857	Introduction to Embedded Systems	2	0	2	3	ECE
22EC858	Microprocessors and Microcontrollers	2	0	2	3	ECE
22EC859	Smart & Virtual Instrumentation	2	0	2	3	ECE
22EC860	Wireless Sensor Networks	2	0	2	3	ECE
22EE851	Fundamentals of Solar Cells	2	2	0	3	EEE
22EE852	Solar Photovoltaic Systems	2	2	0	3	EEE
22EE853	Design and Economics of Solar PV Systems	2	2	0	3	EEE
22EE854	Solar Thermal Energy Conversion Systems	2	2	0	3	EEE
22EE855	Fundamentals of Electric Vehicles	2	2	0	3	EEE
22FT851	Human Nutrition	2	2	0	3	FT
22FT852	Traditional Foods	2	0	2	3	FT
22IT851	Mobile Application Development	2	2	0	3	IT
22IT852	Object Oriented Programming	2	2	0	3	IT
22IT853	Open Source Web Technologies	2	2	0	3	IT
22IT854	Python Programming	2	2	0	3	IT
22IT855	Web Technologies	2	2	0	3	IT
22MS851	Marketing and Human Resource Management	2	2	0	3	Management studies
22MS852	Organisational Behavior	2	2	0	3	Management studies
22MS853	Principles and Practices of Management	2	2	0	3	Management studies
22MT851	Applied Operational Research	2	2	0	3	Mathematics
22MT852	Business Mathematics	2	2	0	3	Mathematics
22MT853	Financial Mathematics	2	2	0	3	Mathematics
22MT854	Finite Differences and Numerical Analysis	2	2	0	3	Mathematics
22MT855	Fuzzy Mathematics	2	2	0	3	Mathematics
22MT856	Graph Theory	2	2	0	3	Mathematics
22MT857	Industrial Mathematics	2	2	0	3	Mathematics
22MT858	Integral Transformations	2	2	0	3	Mathematics
22MT859	Mathematical Cryptography	2	2	0	3	Mathematics
22MT860	Number Theory	2	2	0	3	Mathematics
22MT861	Optimization Techniques	2	2	0	3	Mathematics

22MT862	Vector Spaces	2	2	0	3	Mathematics
22ME851	3D Printing	2	2	0	3	MECH
22ME852	Operations Research for Engineers	2	2	0	3	MECH
22ME853	Reliability Engineering	2	2	0	3	MECH
22PY851	Advanced Engineering Materials	2	0	2	3	Physics
22PY852	Photonics	2	0	2	3	Physics
22PY853	Photovoltaics and Fuel Cell Technology	2	0	2	3	Physics
22PY854	Physical Methods in Biology	2	0	2	3	Physics
22PY855	Renewable Enerygy Technologies	2	0	2	3	Physics
22PY856	Spintronics	2	0	2	3	Physics
22PY857	Thin Film Technology	2	0	2	3	Physics
22RA851	Autonomous Aerial Vehicles	2	2	0	3	RA
22RA852	Condition Monitoring of Engineering Systems	2	2	0	3	RA
22RA853	Robotics for Engineers	2	2	0	3	RA
22TP851	Economic and Social Development of India	3	0	0	3	T&P
22TP852	Modern India History and Indian Culture	3	0	0	3	T&P
22TP853	Polity and Governance in India	3	0	0	3	T&P
22TT851	Fashion Theory	2	2	0	3	TT
22TT852	Costing of textile and apparel production	2	2	0	3	TT
22TT853	Fashion marketing and visual merchandising	2	2	0	3	TT

22BI851 – ELEMENTS OF BIOINFORMATICS

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basics of Biology, Biological Databases

COURSE DESCRIPTION AND OBJECTIVES:
This course provides insights on different elements of Bioinformatics which includes Databases, molecules visualization and sequence analysis.

MODULE -1

UNIT-1 **6L+0T+6P=12 Hours**

BIOLOGICAL DATABASES AND ITS TYPES:
Primary and secondary databases, Nucleic acid Databases, Primary (NCBI, DDBJ & EMBL, Protein Databases - UniProt and PDB), Secondary (PIR, SCOP, CATH).

UNIT-2 **10L+0T+10P=20 Hours**

SEQUENCE ANALYSIS:
Various sequence file formats in bioinformatics, Formats - (plain sequence format, EMBL, Flat, Fasta, FastQ, GCG, Genbank and IG); Basic concepts of Scoring matrices: (PAM and BLOSUM), various versions of BLAST and interpretation of results.

PRACTICES:

- Retrieval of DNA, RNA sequences from GenBank, DDBJ, AND EMBL.
- SWISSPROT - searching and retrieval of protein sequences in different formats for analysis by various softwares.
- PIR - using of protein information resource to support genomic and proteomic research activities.
- TrEMBL - a supplement of SWISS-PROT for analysing and evaluating protein
- sequences.
- PDB - retrieval of protein structure for analysis.

MODULE -2

UNIT-1 **6L+0T+6P=12 Hours**

SEQUENCE ALIGNMENT AND VISUALIZATION:
Pairwise sequence alignment, DOT Plots (BLAST and FASTA), Dynamic programming algorithms, Pairwise alignment methods such as Smith-Waterman and Needleman-Wunsch; Multiple sequence alignment; ClustalW, T-Coffee.

UNIT-2 **10L+0T+10P=20 Hours**

PROTEIN SEQUENCE ANALYSIS:
Amphiphilicity detection using Kyte- Dolittle plot; use of HMM for Transmembrane prediction; Protein secondary structure prediction by using Chou-Fassman, GOR, J Pred and Garnier.

PRACTICES:

- SCOP - analyze proteins having structural similarities for checking the common evolutionary origin.
- CATH - classification of protein structures based on sequences downloaded from PDB.
- Pfam - multiple sequence alignment of proteins in to clans and families.
- PROSITE and BLOCKS - database of protein families and domains.
- UCSC Genome Browser - UCSC on-line genome browser access to genome sequence data from a variety of vertebrate and invertebrate species integrated with a large collection of aligned annotations.

SKILLS:

- Sequence retrieval from biological databases.
- Identifying the similarity between protein sequences.
- Analyzing and evaluating the protein sequences.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Choose the sequence data of biomolecules from databases.	Apply	1	1,2,5,9,10
2	Apply the tools for protein sequence alignment	Apply	2	2,4,5,9,10
3	Analyse the similarly index among the set of sequences.	Analyse	1	2,3,4,5,9,10
4	Predict the protein secondary structure using *in silico* tools.	Evaluate	2	3,5,6,9,10

TEXT BOOKS:

1. Aurther M Lesk, "Introduction to Bioinformatics", 3rd edition, Wiley, 2019.
2. Asheesh Shanker, "Bioinformatics: Sequences, Structures, Phylogeny", 1st edition, Springer nature Pte Ltd, 2018.

REFERENCE BOOKS:

1. Jonathan Pevsner, "Bioinformatics and Functional Genomics" 2nd edition, Wiley-Liss, 2015
2. Richard Durbin, Sean Eddy, Anders Krogh, Graeme Mitchison, "Biological Sequence Analysis Probabalistic Models of Proteins and Nucleic Acids", 2nd edition, Cambridge University Press, 2013.
3. Holmes RM, "A Cell Biologists Guide to Modelling and Bioinformatics", 1st edition, Wiley Inter Science, 2014.

Image source: https://www.freepik.com/premium-vector/isometric-bioinformatics-technology-vector-concept_18183410.htm
Image file name: ELEMENTS OF BIOINFORMATICS

22BI852 – CHEMINFORMATICS AND QSAR

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Drug design

COURSE DESCRIPTION AND OBJECTIVES:

This course is intended to deliver strong foundation in biochemistry and enzymology concepts. It includes macromolecules and their metabolism. It also covers the fundamentals of enzymology, classification, kinetics and immobilization techniques.

MODULE -1

UNIT-1 **6L+6T+0P=12 Hours**

INTRODUCTION TO CHEMINFORMATICS:

The domain of Chemistry - The scope of Cheminformatics - Learning in Cheminformatics, Structure Elucidation - Quantitative Structure - Activity Relationships - Chemical Reaction and synthesis design.

UNIT-2 **10L+10T+0P=20 Hours**

DATABASES AND DATA SOURCES IN CHEMISTRY:

Data, Information and Knowledge Data Preprocessing - Variable selection - Preparation of datasets for validation of the model quality - Databases in the Information System-Catalogs of Chemical Compound - ChemInform RX-Reaction Retrieval.

PRACTICES:

- List the different databases for retrieval of ligands
- List different cheminformatics tools

MODULE -2

UNIT-1 **6L+6T+0P=12 Hours**

CALCUALTION OF DESCRIPTORS:

Empirical approaches to the Calculation of Properties - Drug Receptor Binding energies - Quantitative Descriptors of Chirality - BCUT Descriptors - HYBOT Descriptors - 4D QSAR

UNIT-2 **10L+10T+0P=20 Hours**

APPLICATIONS:

Prediction of Properties of Compounds - Linear Free Energy Relationship (LFER) - Quantitative Structure-Property Relationship (QSAPR) model - Target Identification and Validation - Lead Finding and Optimization

PRACTICES:

- How do you predict the properties of compounds?
- What is the QSAPR model
- Calculation of the binding energy between receptor and ligand Estimation of Michaelis -Menten

parameters.

SKILLS:

- Detection of macromolecules by biochemical and calorimetric assays.
- Quantification of biomolecules using spectrophotometer.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	To retrieve specific information from the enormous and rapidly expanding chemical literature	Apply	1	1,2,4,9,10
2	To provide a broad overview of the computer technology to chemistry in all of its manifestations	Understand	1	1,2,5,9,10
3	To expose current and relevant applications in QSAR and Drug Design	Apply	2	1,3,9,10

TEXT BOOKS:

1. Wendy A. Warr, Jürgen Bajorath "Chemoinformatics and Computational Chemical Biology", 1st edition, Humana Press, 2011.
2. Jürgen Bajorath, "Chemoinformatics for Drug Discovery", 1st edition, WILEY, 2013.

REFERENCE BOOKS:

1.Andrew R. Leach and Valerie J. Gillet, "Introduction to Cheminformatics", Kluwer Academic Publisher, Netherlands, 2013.

2. Andrew R. Leach, "An Introduction to chemoinformatics", 1st edition, Springer, 2020.

3. Bajorath, "Chemoinformatics for drug discovery", 1st edition, John Wiley, 2014.

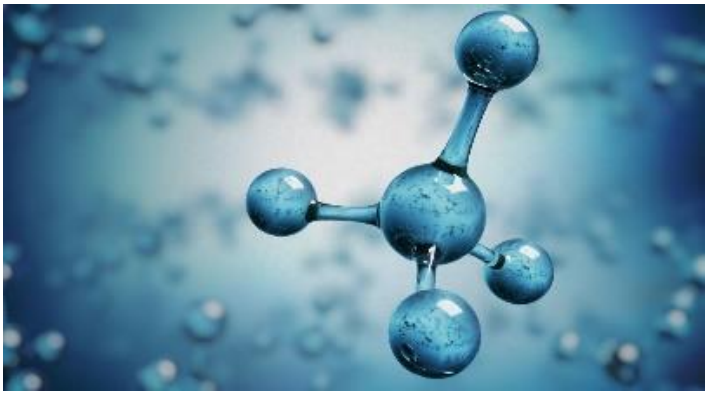

Image source: https://www.gsitechnology.com/Introducing-a-Cheminformatics-Similarity-Structure-Search-Solution

Image file name: CHEMINFORMATICS and QSAR

22BI853 – COMPUTER AIDED DRUG DESIGN

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Biology, chemistry and Computers

COURSE DESCRIPTION AND OBJECTIVES:

This course offers knowledge on current approaches and principles of drug design processes. It helps to learn the different computational drug designing techniques to develop the novel, safe and effective drugs which reduce the cost and time of drug discovery process.

MODULE -1

UNIT-1 **6L+0T+6P=12 Hours**

INTRODUCTION TO DRUG DISCOVERY:

Drugs; principles of drug development; Chemoinformatics and Pharmacoinformatics; Structure-based drug designing approaches - target identification, hit validation, active site/binding site prediction and analysis, Molecular Docking and types

UNIT-2 **10L+0T+10P=20 Hours**

TYPES OF DRUG DESIGN:

Ligand-based drug designing approaches – lead designing, combinatorial chemistry, High Throughput Screening (HTS), QSAR, 2D-QSAR, Pharmacophore mapping; Database generation and Chemical libraries; ADME properties.

PRACTICES:

- Perform Homology modeling using I-TASSER
- Docking studies using Auto Dock Vina
- Active site prediction of protein using CastP
- Protein secondary structure prediction using SOPMA
- QSAR studies of drug

MODULE -2

UNIT-1 **6L+0T+6P=12 Hours**

DRUG ACTION:

Theories of enzyme inhibition and inactivation; Enzyme activation of drugs and prodrugs; Concept of drug like molecules; Pharmacophore hypotheses; Lipinski’s rule of five.

UNIT-2 **10L+0T+10P=20 Hours**

DRUG DESIGN POLICIES:

Quality assurance; ISO; WHO; NIH; NDA; Food and Drug Administration (FDA); IPR; Good Manufacturing Practices (GMP); Good Laboratory Practices (GLP).

PRACTICES:

- Retrieving pathways from KEGG & BRENDA.
- Finding out drug likeliness using Lipinski's rule of five.
- Smiles notation of drug compounds.
- Design of ligands by Chemdraw.

SKILLS:

- Performing Homology modelling of proteins.
- Docking of ligand with corresponding target.
- Protein secondary structure prediction using Ramachandran Plot.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the steps involved in ligand-receptor and ligand-enzyme binding for novel drug discovery.	Apply	1	2,5,3,9,10
2	Analyze the approaches of drug discovery processes.	Analyse	1	1,2,4,6,9,10
3	Create 3D structures of macromolecules by applying homology modelling techniques.	Design	2	3,4,5,9,10
4	Evaluate the pharmacokinetics and pharmacodynamics of novel drugs.	Evaluate	2	3,4,5,9,10

TEXT BOOKS:

1. K. I. Ramachandran, Gopakumar Deepa and Krishnan Namboori, "Computational Chemistry and Molecular Modeling", 1st edition, Springer, 2013.
2. Hans-Dieter Holtje, Wolfgang Sippl, Didier Rognan and Gerd Folkers, "Molecular Modeling: Basic Principles and Applications", 3rd edition, Wiley, 2013.

REFERENCE BOOKS:

1. Tagelsir Mohamed Gasmelseid, "Pharmacoinformatics and Drug Discovery Technologies: Theories and Applications", 1st edition, Idea Group, 2012.
2. Jan H. Jensen, "Molecular Modeling Basics", 1st edition, CRC Press, 2015.
3. M. Rami Reddy, Mark D. Erion, "Free Energy Calculations in Rational Drug Design", 1st edition, Springer, 2014.

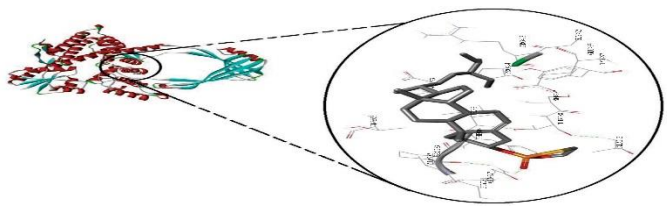

Image source: Computer aided drug design - Bing images

Image file name: COMPUTER AIDED DRUG DESIGN

22BT853- COMPUTATIONAL BIOLOGY

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Structural Bioinformatics and Bioanalytical techniques

COURSE DESCRIPTION AND OBJECTIVES:

The course offers the knowledge on current approaches and principles of drug design process and its policies. It helps to learn the different computational drug designing techniques to develop the novel and safe effective drugs which reduce the cost and time of drug discovery process.

MODULE -1

UNIT-1 **6L+0T+6P=12 Hours**

COMPUTATIONAL BIOLOGY AND DATABASES:

Computational tools in biology and medicine; Overview of biological databases; Nucleic acid & protein databases; Primary, secondary, functional, composite, structural classification database, Sequence formats & storage, Access databases, limitations of existing databases.

UNIT-2 **10L+0T+10P=20 Hours**

SEQUENCE ALIGNMENTS:

Local alignment; Global alignment, scoring matrices PAM, BLOSUM, Gaps and penalties, Dot plots, Dynamic programming approach: Needleman and Wunsch Algorithm, Smith and Waterman Algorithm; Heuristic approach: BLAST, FASTA.

PRACTICES:

- Analyzing nucleotide sequence from NCBI.
- Annotating protein sequence from Swiss Prot.
- Construct Dot Plot.
- Perform local alignment using Smithwatermann algorithm.
- Perform global alignment using Needleman Wunsch algorithm.

MODULE -2

UNIT-1 **6L+0T+6P=12Hours**

GENOME ANALYSIS:

Polymorphisms in DNA sequence; Next Generation Sequencing technologies; Whole Genome Assembly and challenges; Sequencing and analysis of large genomes; Gene prediction; Functional annotation; Comparative genomics; Human genome project.

UNIT-2 **10L+0T+10P=20 Hours**

MOLECULAR MODELING:

Different types of protein chain modelling: *ab initio*, homology, hybrid, loop; Template recognition and alignments; Modelling parameters and considerations; Model analysis and validation; Model

optimization; protein folding and model generation; loop generating methods; loop analysis; Analysis of active sites using different methods in studying protein–protein Interactions and Molecular Docking.

PRACTICES:

- ORF prediction by NCBI-ORF finder.
- Gene prediction by Genscan, Genewise, Gene finder.
- Perform homology modeling of a protein using I-**TASSER.**
- Predict protein secondary structure using SOPMA.
- Docking studies by Auto Dock Vina.
- *In silico* determination of exons and introns in a gene.

SKILLS:

- Analyzing biomolecules using suitable databases.
- Predicting different forms of protein structure.
- Evaluation of stable interactions between target protein and ligand using molecular docking.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Integration of computational programme to fetch answers for biosystems.	Apply	1	2,3,5,9,10
2	Analyze pharmacokinetics and pharmacodynamics of drugs.	Analyze	2	2,4,5,7,9,10
3	Develop logical thinking to analyze biological problems.	Create	1	1,2,5,9,10
4	Develop robust programming by implementing dynamic programming skills.	Create	2	3,4,5,6,9,10

TEXT BOOKS:

1. Dokholyan NV, "Computational modeling of biological systems: from molecules to pathways", 1st edition, Springer Science & Business Media, 2012.
2. Basant K. Tiwary, Bioinformatics and Computational Biology: A Primer for Biologists, 1st edition, Springer, 2021.

REFERENCE BOOKS:

1. Blossey, Ralf, "Computational biology: a statistical mechanics perspective" 2nd edition, CRC Press, 2020.
2. Robinson PN, Piro RM, Jager M, "Computational exome and genome analysis", 1st edition, CRC Press, 2017.
3. Waterman MS, "Introduction to computational biology: maps, sequences and genomes", 1st edition, Chapman and Hall/CRC, 2018.

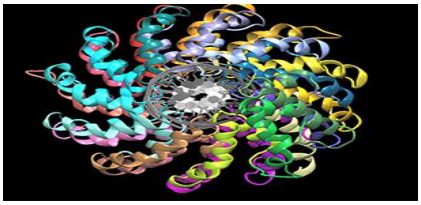

Image source: Structural and Computational Biology | Moleküler Biyoloji, Genetik ve Biyomühendislik (sabanciuniv.edu)
Image file name: **COMPUTATIONAL BIOLOGY**

22BI854 – VACCINE DESIGN

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basics of Biology, Immunology and Immunoinformatics

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the topics related to history of vaccination, importance of vaccination and types of vaccine platforms. The topics relating to the vaccine design and vaccine manufacturing are also indicated in the syllabus. Hence, the students who undergo this course will acquire knowledge on the herd immunity, adult vaccination schedule and sustenance of community health.

MODULE -1

UNIT-1 **6L+0T+6P=12 Hours**

FUNDAMENTALS OF IMMUNOLOGY:

History of vaccination; Importance of vaccination; Immune cells and their role in the elicitation of immune response; HLA, Antigen presentation, Adaptive and Innate Immunity.

UNIT-2 **10L+0T+10P=20 Hours**

VACCINE PLATFORMS:

Live; killed; attenuated; subunit vaccines; recombinant antigen, vectored DNA vaccines, m RNA vaccines, Vaccination routes; Properties of adjuvants; Pneumococcal conjugate vaccines; Toxoids and anti-toxins

PRACTICES:

- Antigen selection from the viral pathogens of the choice of student. BrowsingNCBI for the sequence of the chosen antigen.
- Prediction of sequential and conformational epitopes for the chosen antigen. Epitope prediction using RANKPEP.
- Allergy prediction using AlerTop. Toxicity prediction.
- Determine the antigenic potential of the chosen protein sequence.

MODULE -2

UNIT-1 **6L+0T+6P=12 Hours**

MANUFACTURING OF VACCINES:

Procedure for Vaccine manufacture; Vaccine, safety; Clinical evaluation; Role of regulatory agencies in vaccine testing and licensing; Domestic and international vaccine policy; Ethical considerations and regulatory issues.

UNIT-2 **10L+0T+10P=20 Hours**

VACCINE DESIGN:

Reverse vaccinology; Design protein based vaccines, Design DNA based vaccines, Recombinant plasmid construct as vaccine, Vaccine design using online tools; Epitope based vaccines, Polytope based vaccines, HLA haplotypes, Population coverage.

PRACTICES:

- Design vaccine with the chosen antigen using online tools.
- Population coverage using IEDB tool.
- Building a model of SCFV antibody.
- Building a model of Reverse Vaccinology.
- Building a model for the promotion of vaccination in the population.
- Prepare a protein-based vaccine and immunize a mouse. Evaluate antibody titer.

SKILLS:

- Epitope prediction.
- Design of protein-based vaccines.
- Prediction of toxicity due to vaccine.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyze the importance of vaccination in evaluating human health and national wealth.	Analyze	1	1,2,5,9,10
2	Evaluate the role of vaccines in the prevention of communicable and therapeutic diseases.	Evaluate	1	2,3,5,9,10
3	Evaluate the bioinformatics tools to design vaccine.	Evaluate	2	3,4,5,9,10
4	Design experimental outline for preparation of different classes of vaccines such asrecombinant, live attenuated, killed vaccines.	Create	2	2,4,5,9,10

TEXT BOOKS:

1. Kindt TJ, Goldsby RA, Osborne BA, Kuby J. Kuby, "Immunology", 9th edition, WH Freeman, 2016.
2. Kenneth Murphy, "Janeway'sImmunobiology", 9th edition, Garland Science, 2016.

REFERENCE BOOKS:

1. Morrow WJ, Sheikh NA, Schmidt CS, Davies DH, "Vaccinology", 1st edition, Blackwell Publishing, 2012.
2. Glick BR, Patten CL, "Molecular Biotechnology: Principles and Applications of Recombinant DNA", 6th edition, John Wiley & Sons, 2022.
3. Tomar N, "Immunoinformatics", 1st edition, Humana Press, 2020.

Image source: New vaccine design reduces inflammation, enhances protection | Pritzker School of Molecular Engineering | The University of Chicago (uchicago.edu)

Image file name: **VACCINE DESIGN**

22BM851– BASIC CLINICAL SCIENCES

Hours per week:

L	T	P	C
2	2	0	3

https://www.google.com/search?q=basic+clinical+sciences&sxsrf=

PREREQUISITE KNOWLEDGE: Fundamentals of Anatomy & Physiology

COURSE DESCRIPTION AND OBJECTIVES:

A clinical science gives a perceptive to students on various aspects of clinical diseases and the measurable parameters for diagnosis and gives a view on instruments for treatment and other assistive devices.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

NEPHROLOGY:

Principles and types of dialysis, Components of dialyzing system, Dialysate, Composition of dialysate, Types of dialyzers, Clinical significance, Renal transplantation

UNIT-2 **10L+10T+0P=20 Hours**

NEUROLOGY:

Diseases of nervous system (Alzheimer's disease, Parkinson's disease, ALS), Spinal cord lesions, Motor nervous disease, Prolapsed intervertebral disc, Neuropathies, Myasthenia gravis, Diseases of muscle - myopathy.

PRACTICES:

- Design a proto type of reusable dialyzer
- Design a Portable dialyzer
- Records the brain's continuous electrical activity through electrodes attached to the scalp.
- Records the brain's electrical response to visual, auditory, and sensory stimuli
- Case Study: Critical analysis of the symptomatic and asymptomatic symptoms of Alzheimer's disease, Parkinson's disease, ALS.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

GASTROENTEROLOGY: Anatomy and physiology and G.I.T diseases - stomach (ulcers), liver (jaundice), gall bladder (gall stone); Disease diagnosis and treatment, Juices-Gastric, Bile, Pancreatic, Intestinal, functions and clinically significant symptoms - signs, diseases, Instruments used in gastroenterology.

UNIT-2 **8L+8T+0P=16 Hours**

GENERAL SURGERY: Clinically significance, Preoperative care, Postoperative care, Study of operation of surgical equipment, Laparoscopy, Endoscopy and intubation tubes.

PATHOLOGY& BLOOD BANK: ESR, Electrolyte estimation of normal values, HIV test - ELISA, dot method, cross matching of blood, cell counter, normal blood coagulation factors, normal bilirubin.

PRACTICES:

- Distinguish different diagnostic test process of gastrointestinal disorders.
- Evaluate the Instruments used in gastroenterology.
- Case Study: Pre and Postoperative care of cancer patient.
- Evaluate the Laparoscopy, Endoscopy and intubation tubes.
- Determination the ESR/ELISA/blood cell counting (dot/cross matching method) using microscope.

SKILLS:

- Demonstration of instruments and kidney transplantation
- Analyse the various diseases and their appearances**.**
- Determine the physics behind diagnostic instruments.
- Application of Pre and Postoperative care procedures

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the concepts of dialysis to determine the performance of dialysis of treatment and design of dialyzer	Apply	1	1, 2, 9,10,12
2	Apply the conditions and symptoms for identification of neurological diseases	Apply	1	1, 2, 5, 9,10, 12
3	Analyse the diseases of the GI tract and instruments used for diagnosis.	Analyze	2	1, 2, 4, 5, 9,10,12
4	Analyse the conditions of patient in pre and post-operative cares of patient	Analyze	2	1, 2,4, 9,10,12
5	Categorize the blood transfusion compatibility based on grouping and other important factors using the blood cell counters/ESR/ELISA	Evaluate	2	1, 2,4,5, 9,10

TEXT BOOKS:

1. Elaine.N.Marieb, "Essential of Human Anatomy and Physiology",12th edition, Pearson Education, 2017.
2. Gerard J. Tortora, Bryan D. "Principles of Anatomy and Physiology", 14thedition, John Wiley & Sons INC, 2014

REFERENCE BOOKS:

1. Michael Zigmond, Joseph Coyle, Lewis Rowland, "Neurobiology of Brain Disorders", Academic Press, 2014.
2. Jeffrey A. Morgan, Andrew B. Civitello, O.H. Frazier, "Mechanical Circulatory Support for Advanced Heart Failure", Springer, 2018.
3. Jones DB, Wu JS, Soper NJ, "Laproscopic surgery: Principles and Procedures", 2nd edition, Marcel Dekker, 2019.

22BM852 - BIOMEDICAL INSTRUMENTATION

Hours per week:

L	T	P	C
2	0	2	4

https://www.info4eee.com/2014/04/introduction-to-biomedical.html

PREREQUISITE KNOWLEDGE: Signals and Systems, Analog and Digital Electronics

COURSE DESCRIPTION AND OBJECTIVES:

This course includes the basic and advanced principles, concepts, and operations of medical sensors and devices, the origin and nature of measurable physiological signals and also including design of electronic instrumentation. This course aimed to impart the knowledge of realistic design and experimentation with amplifiers for biopotential measurement.

MODULE-1

UNIT-1 **6L+0T+6P=12 Hours**

MEDICAL INSTRUMENTATION:

Block diagram; Bio-signals: Bio potentials-ECG, EEG, EGG, EMG, ENG, EOG, and ERG; Problems encountered with measurements from human beings; specifications, Electrode - electrolyte interface, half-cell potential, offset voltage; Types of Electrodes - external, internal and microelectrodes; Mathematical treatment of electrodes – equivalent circuits and applications.

UNIT-2 **10L+0T+10P=20 Hours**

CARDIAC INSTRUMENTATION:

ECG block diagram and circuits, Electrodes and their placement; Lead configuration and ECG waveforms; ECG monitors - single and multi-channel ECG systems, Holter monitors, stress test systems. Blood flow measurement electromagnetic and ultrasonic techniques; Phonocardiography, Cardiac Pacemaker.

PRACTICES:

- Demonstrate wet, dry and gel electrode configurations using Impedance analyzer.
- ECG, EEG and EMG signals acquire and analyze by using simulator and real time
- Develop and apply equivalent circuits for biomedical instruments

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

NEURO-MUSCULAR INSTRUMENTATION:

EEG block diagram and circuits, Electrodes placement, Lead configuration and EEG graphs; Evoked potentials, Filters for EEG rhythm analysis, EMG - EMG block diagram and circuits, Electrodes placement; NCV, Stimulators for EMG recording.

UNIT-2 **8L+0T+8P=16 Hours**

MEDICAL ANALYTICAL INSTRUMENTATION:

Methods of chemical analysis, Absorption photometry, Emission photometry, Flurometry, Colorimeter, Spectrophotometer, Flame photometer, Mass spectrophotometer, Chromatography, Blood gas analyzer, Semi and fully automated analyzers.

PRACTICES:

- Design of Instrumentation amplifiers for ECG/ EEG/ EMG.
- Design of filters for ECG/ EMG/ EEG.
- Apply Holter monitors technique to ECG
- Colorimeter.
- Spectrophotometer.
- Electrophoresis

SKILLS:

- Study of biomedical instrumentation and their parameters.
- Study of different display devices.
- Determination of bio potentials and how they are interpreted.
- Extraction of biological signals and feeding them to instruments to make meaning out of it.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Classify characteristics of biopotentials	Apply	1	1, 2, 4,5, 9,10, 12
2	Apply the volume conductor principles to interpret ECG waves and suggest cardiac assist devices	Apply	1	1, 2, 5, 9,10, 12
3	Analyse the recording of neuro muscular signals	Analyze	1	1, 2, 5, 9,10,12
4	Design hardware and software tools / methods to analyse biological signals	Analyze	2	1, 2, 3,4, 9,10, 12
5	Evaluate the properties of biological samples using various medical analytical instrumentation.	Evaluate	2	1, 2,4,5, 9,10

TEXT BOOKS:

1. Webster J.G., "Medical Instrumentation Application and Design", 4th edition, Houghton Mifflin, 2015.
2. Khandpur R.S. "Hand Book of Biomedical Instrumentation", 3rd edition, Tata McGraw-Hill, 2014.

REFERENCE BOOKS:

1. Carr and Brown, "Introduction to Biomedical Equipment Technology", 4th edition, Pearson, 2012.
2. Lurence J Street, "Introduction to Biomedical engineering technology", 3rd edition, Taylor & Francis -Hill, 2016.
3. John Enderle, Susan M. Blanchard, and Joseph Bronzino, "Introduction to Biomedical Engineering", 2nd edition, 2015.

22BM853 - DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS

https://depositphotos.com/100760536/stock-photo-advance-ultrasound-machine-in-hospital.html

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Analog circuits, Analog and linear ICs

COURSE DESCRIPTION AND OBJECTIVES:

This course explains the concepts about human-instrument system and problems encountered in obtaining measurements from a living body. It also deals with basics of measuring the parameters in respiratory system, learn measurement techniques of sensory responses and understand different types and uses of diathermy units. It also gives knowledge of ultrasonic therapeutics and diagnosis.

MODULE-1

UNIT-1 **6L+0T+6P=12 Hours**

PATIENT MONITORING SYSTEMS:

Special care units, ICU/CCU equipments, Bed side patient monitoring systems – multi-parameters, measurement of heart rate and pulse rate, Holter monitor, phonocardiography, plethysmography, recording system; Oximeters -principle, intravascular oximeter; Cardiotacograph, Methods of monitoring foetal heart rate, Monitoring labour activity, Baby incubator.

UNIT-2 **10L+0T+10P=20 Hours**

DIATHERMY:

Short wave diathermy, Ultrasonic diathermy, Microwave diathermy, Electro surgery machine - current waveforms, tissue responses, electrosurgical current level, surgical diathermy analyzers, hazards and safety procedures.

PRACTICES:

- Multipara meter monitoring system.
- Heart sound measurement using phonocardiography
- Design Cardiotacometer
- Design phonocardiography
- Design Patient monitoring system
- Shortwave diathermy
- Ultrasonic diathermy
- Long wave diathermy
- Inspection ESU – cutting and coagulation modes.
- Design syringe and Infusion Pumps

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

EXTRA CORPOREAL DEVICES AND THERAPEUTIC TECHNIQUE:

Lithotripsy - Stone Disease Problem, First Lithotripter Machine, Modern Lithotripter Systems; Extracorporeal Shockwave Therapy, Principles of Cryogenic Technique and Application, Thermotherapy, Hyperthermia, High Intensity Focused Ultrasound (HIFU), Thermography – Recording and Clinical Application.

UNIT-2 **8L+0T+8P=16 Hours**

ELECTRICAL SAFETY:

Physiological effects of electricity, Importance susceptibility parameters, Distribution of electric power, Macro shock hazards, Microshock hazards, Electrical - safety codes and standards, protection against shock; Protection - electrical safety analyzers, testing electric system, tests of electric appliances, problems.

PRACTICES:

- Predict the thermal effects of tissue by operation of Hyperthermia through simulation
- Predict the thermal effects of tissue by operation of High intensity focused ultrasound therapy simulation
- Electrical safety measurements
- Examine the Protection of electrical safety issue of instruments

SKILLS:

- Differentiate various instruments in hospitals for trouble shooting
- Determine diagnostic techniques used in health care.
- Investigate the breakdown of diagnostic and therapeutic equipments.
- Evaluate the procedures for safely carrying out therapeutic process

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Classify critical equipment into various units	Analyze	1	1, 2, 4, 9,10
2	Distinguish the different diathermy equipment by applying physics laws and Evaluate the diathermy units to estimate the treatment plans.	Analyze	1	1, 2, 5, 9,10,12
3	Design the components and working of drug delivery systems	Analyze	1	1, 2, 3, 5, 9,10,12
4	Apply ultrasound physics to realize the treatment of kidney stones, cancer	Analyze	2	1, 2,4 9,10,12
5	Evaluate the electrical safely carrying out therapeutic devices in hospitals	Evaluate	2	1, 2,4,5 9,10

TEXT BOOKS:

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", 3rd edition, Tata McGraw Hill, 2014.
2. Leslie Cromwell, "Biomedical Instrumentation and Measurement", 4rd edition, Prentice Hall, 2015.

REFERENCE BOOKS:

1. John G. Webster, "Medical Instrumentation Application and Design", 4th edition, John Willey and Sons, 2015.
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", 4th edition, Pearson Education, 2014.
3. L.A Geddas and L.E.Baker, "Principles of Applied Biomedical Instrumentation", 3rd edition, 2017.
4. Myer Kutz "Standard Handbook of Biomedical Engineering and Design", McGraw-Hill Publisher, 2013.

22BM854 - MEDICAL IMAGING MODALITIES

https://openmedscience.com/medical-imaging/

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Engineering Physics, signals and systems, Biomedical Instrumentation

COURSE DESCRIPTION AND OBJECTIVES:

This course studies the image reconstruction techniques, quality assurance test for radiography, method of recording sectional image, functioning of radioisotopic imaging equipment and the MRI, image acquisition and reconstruction, it also explains the 3-D image display techniques. This course aimed at imparting knowledge of operation and medical applications of the major medical imaging techniques.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

X-ray, CT, Ultrasound, MRI, PET-CT, SPECT-CT, Gamma Camera, Catheterization Lab. Image perception, Image acquisition, Display, Image processing operations, scanning.

X-RAY: X-Ray imaging, Fundamentals of X-ray, Electromagnetic radiation, Interactions between X-rays and matter, Intensity of X-ray beam, Attenuation, Generation and detection of X-rays, biological effects of ionizing radiation; X-Ray diagnostic methods - conventional X-ray radiography, fluoroscopy, angiography, mammography and xeroradiography.

CT: Conventional tomography, Computed tomography - projection function, algorithms for image reconstruction, multiplanar reconstruction, non-spiral CT technology, concepts of spiral CT scanner, multi slice spiral technology, Recent applications – CT angio, cardiac CT, dual energy CT.

UNIT-2 **10L+10T+0P=20 Hours**

ULTRASOUND IMAGING: Fundamentals of acoustic propagation - characteristic impedance, intensity, reflection and refraction, attenuation, Doppler effect; Generation and detection of Ultrasound - piezoelectric effect, ultrasonic transducers.

ULTRASONIC DIAGNOSTIC METHODS: Pulse echo systems - amplitude mode (A-mode), brightness mode (B-mode), motion mode (M-mode), 3D, 4D, Doppler methods, duplex imaging, colour Doppler flow imaging, image artifact, biological effects of ultrasound.

PRACTICES:

- Analyse the radiation exposure to patients by using low kV values
- Evaluate the prevention of unnecessary exposure to patients in digital radiography
- Evaluate the rejection analysis in radiography reduce unnecessary exposure to patients
- Determines the Quality of the chemical processing of radiographic film have any effect on the radiation exposure of a patient
- Determines the radiation dose to the breast of patients in mammography
- Determines the radiation exposure to a patient affected by the size of the image (area covered by the X-ray beam)
- Apply the reconstruction techniques of the CT images for generation of image

- Analysis the radiation doses to patients undergoing cardiac CT procedures compare to doses from other radiographic procedures
- Design and Develop the ultrasound transducer
- Determines the ultrasound modes for examine the diseases

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

MAGNETIC RESONANCE IMAGING: Basics of magnetic resonance imaging, Fundamentals of nuclear magnetic resonance - angular momentum, magnetic dipole moment, magnetization, larmour frequency, free induction decay (FID), Fourier spectrum of the NMR signal, spin density, relaxation times, pulse sequences.

MRI SYSTEM & IMAGING METHODS: Introduction, Magnet, NMR Coil/Probe, Transmitter, Receiver, Data acquisition; Imaging methods - introduction, slice selection, frequency encoding, phase encoding, spin-echo imaging, gradient echo imaging; Characteristics of MRI images - spatial resolution, image contrast, biological effects of magnetic fields, static magnetic fields, radiofrequency fields, gradient magnetic fields, imaging safety, functional MRI (brief introduction only).

UNIT-2 **8L+8T+0P=16 Hours**

NUCLEAR IMAGING:

Physics of gamma camera, Basic instrumentation, Imaging techniques, SPECT and whole body studies; Applications of gamma camera in cardiology, Nephrology, Neurology etc., PET - fundamentals of PET scanner and PET- CT, crystal technology, cyclotron principle, Applications of PET - cardiology, neurology and cardiology.

PRACTICES:

- Analysis the MRI compare with doses from other examinations.
- Determine the reconstruction techniques of the MRI images for generation of image
- Analysis the PET/CT radiation doses compare with doses from other examinations.
- Determine the patient exposure PET/CT radiation given in an examination
- Determine the optimize image quality in a gamma camera examination
- Determine the optimization in diagnostic nuclear medicine

SKILLS:

- Study the physics behind medical imaging.
- Determine the basis for an image is formation.
- Know the image formation in MRI.
- Grasp the knowledge of CT and importance of a medical department.
- Image acquisition and processing of images for required model.
- Integration of CT_PET for structural and functional analysis of disease.
- Calculate dose limits and differentiate between controlled areas and radiation hazards.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the CT image reconstruction techniques using different algorithms.	Apply	1	1, 2, 4,5 9,10,12
2	Apply the concepts of ultrasound image formation model and its biological effects	Apply	1	1, 2, 5, 9,10,12
3	Identify MRI pulse sequences & hardware systems for tissues imaging and its hardware	Analyze	1	1, 2, 4, 5, 9,10,12
4	Analyse the nuclear spins and the decay systems of NMR	Analyze	2	1, 2,4,5 9,10,12
5	Analyse the SPECT- PET imaging formation techniques in cardiology and neurology.	Evaluate	2	1, 2, 4,5, 9,10,12

TEXT BOOKS:

1. Kirk Shung, Michael B. Smith and Banjamin Tsui, "Principles of Medical Imaging", Academic Press, 2015.
2. Paul Suetens, "Fundamentals of Medical Imaging", 3rd edition, Cambridge University Press, 2017.

REFERENCE BOOKS:

1. Michael Chappell, "Principles of Medical Imaging for Engineers", Springer, 2019.
2. Stewart C.Bushong, Geoffrey Clarke "Magnetic Resonance imaging –Physical and biological principles", Elsvier, 4th edition, 2014.
3. Hykes, Heorick, Starchman, "Ultrasound physics and Instrumentation", MOSBY, 6th edition, 2021.
4. Russell K Hobbie, Bradley J Roth, "Intermediate physics for medicine for biology, Springer, New York, 4th edition, 2013.

22BM855 - BIOMATERIALS

https://www.mdpi.com/2076-3417/8/7/1037/htm

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Engineering Physics, Engineering Chemistry, Biochemistry.

COURSE DESCRIPTION AND OBJECTIVES:

This course aims at imparting the knowledge of material science, chemistry and characteristics and classification of biomaterials. It is useful to learn about different metals and ceramics used as biomaterials, polymeric materials and combinations for mechanism of tissue replacement implants and also gives knowledge of the artificial organ development.

MODULE-1

UNIT-1 **6L+0T+6P=12 Hours**

STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY:

Classification of biomaterials, Mechanical properties, Viscoelasticity, wound healing process, Body response to implants, Blood compatibility.

UNIT-2 **10L+0T+10P=20 Hours**

IMPLANT MATERIALS:

Metallic implant materials, Stainless steels, Co based alloys, Ti-based alloys, Ceramic implant materials, Aluminium oxides, Hydroxyapatite, Glass ceramics, Carbons, Medical applications.

PRACTICES:

- Biomaterial properties analysis
- Design an implants using the metals, metals alloys and polymers with simulation (COMSOL multi-physics)
- Analyze the Polymerization process and techniques suitable for different implants
- Implant materials analysis with respect to Size, Position, load and resection

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

POLYMERIC IMPLANT MATERIALS: Polymerization, Polyamides, Acryrilic polymers, Biopolymers, Medical textiles silica, Chitosan, PLA composites, Sutures, Wound dressings; Materials for ophthalmology.

UNIT-2 **8L+0T+8P=16 Hours**

TISSUE REPLACEMENT IMPLANTS:

Soft tissue replacements, Maxillofacial augmentation, Vascular grafts, Hard tissue replacement Implants.

PRACTICES:

- Hard tissue replacement analysis.
- Bone remodeling analysis.
- Hip replacement model analysis.
- Design of Musculoskeletal structure

- Design of dental implants.
- Design simulation and fabrication of artificial bone.
- Design simulation and fabrication of prostatic heart valves.
- Design simulation and fabrication of sensing elements (Heating aids, Intraocular lens)

SKILLS:

- Classification and investigation of suitable biomaterials
- Study various materials for biocompatibility.
- Analyzation of suitable biomaterials used for medical grafts
- Determine and selection of right materials for its bio applications.
- Apply specific design and quality control.
- Selection of the right materials for prostatics, implants or whole organs replacement with artificial organs.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Classify biomaterials based on biocompatibility and mechanical properties	Analyze	1	1, 2, 4,5 9,10,12
2	Identify suitable metals/ polymers for fabrication of wound dressings and implant/prostatics design.	Analyze	1	1, 2, 4,5, 9,10,12
3	Differentiate the implant materials based on metal composition for different tissues.	Analyze	1	1, 2, 4, 5, 9,10, 12
4	Determine the materials that are compatible for soft tissue and hard tissue replacements	Analyze	2	1, 2,4,5 9,10,12
5	Evaluate the suitability of artificial materials properties for replacement of organ functions	Evaluate	2	1, 2,4,5, 9,10

TEXT BOOKS:

1. Joseph D. Bronzino," The Biomedical Engineering Hand Book, 5th Edition Boca Raton: CRC Press LLC, 2015.
2. John D. Enderle, "Introduction to Biomedical Engineering",4th edition, Academic Press, 2022.

REFERENCE BOOKS:

1. Ernesto Iadanza, "Clinical Engineering handbook",2nd edition, Academic Press, 2020.
2. A.C Anand, J F Kennedy, M. Miraftab, S.Rajendran, "Medical Textiles and Biomaterials for Healthcare", 2nd edition, CRC, 2016.
3.. M.Lysaght, T.J. Webster, "Biomaterials and Artificial organs",1st edition, woodhead publishing, Cambrige,2013.
4. William R Wagner, "Biomaterials Science: An Introduction to Materials in Medicine", Academic Press, 2nd edition, Narosa Publishing House, 2020.

22BT851 - BIOLOGY FOR ENGINEERS

Hours per week:

L	T	P	C
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basics of Biology

COURSE DESCRIPTION AND OBJECTIVES:

The purpose of this course is to provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

CELL STRUCTURE AND SIGNALING:

Origin of Life; Evolution; Cells; Structure and function of Prokaryotic and Eukaryotic cell; Mitosis and meiosis; Metabolism, cell signaling pathways; Cancer: types, diagnosis and treatment.

UNIT-2 **10L+10T+0P=20 Hours**

BIOMOLECULES AND CENTRAL DOGMA:

Classification, structure and properties of Carbohydrates; Proteins; Enzymes; Lipids; Nucleic acids; DNAreplication; Transcription; Translation.

PRACTICES:

- Depict Microscopic illustrations of mitosis and meiosis
- Structural illustration of DNA and RNA
- Diagrammatic representation of DNA replication
- Explore various stages of transcription.
- Preparation of model demonstrating translation process.
- Report on types of cancers and therapies.

MODULE -2

UNIT-1 **6L+6T+0P=12 Hours**

HUMAN PHYSIOLOGY:

Digestive systems and Nutrition; Respiratory system; Heart and circulatory system; Nervous system; Excretorysystem; Immune system; wound healing process.

UNIT-2 **10L+10T+0P=20 Hours**

BIOTECHNOLOGY FOR PRODUCTION OF THERAPEUTICS:

Production of recombinant proteins; Monoclonal antibodies; Vaccines and enzymes; Biosensors: types and applications; Tissue engineering and its applications; Bioengineering applications in healthcare.

PRACTICES:

- Report on challenges in developing vaccine for COVID-19.
- Report on development of biosensors for clinical applications.
- Review on ethical issues involved in tissue engineering.
- Preparation of flow chart for MAB production.

SKILLS:

- Identification of prokaryotic and eukaryotic cells.
- Demonstration of structure and function of biomolecules.
- Design of production process for enzymes, vaccines and antibiotics.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyze origin of life and central dogma of molecular biology	Analyze	1	1,2,4,9,10
2	Distinguish various types, structure and functions of cells	Analyze	1	2,4,9,10
3	Determine role of biomolecules in living organisms	Apply	2	3, 4, 6,9,10
4	Develop process flow sheets for production of vaccines, enzymes and antibiotics.	Create	2	3,4, 7, 8,9,10

TEXT BOOKS:

1. Campbell NA, Urry LA, Cain ML, Wasserman SA, Minorsky PV, Reece JB, "Biology A Global Approach", 11th edition, Pearson Education Limited, 2018.
2. Lee SY, Nielsen J, Stephanopoulos G, "Industrial Biotechnology: Microorganisms", 1st edition, John Wiley & Sons, 2016.

REFERENCE BOOKS:

1. Karp G, "Cell and Molecular Biology: Concepts and Experiments", 2nd edition, John Wiley & Sons, 2016.
2. Bahadur B, Rajam MV, Sahijram L, Krishnamurthy KV, "Plant Biology and Biotechnology", 1st edition, Springer, 2015.
3. Ryan S, McNicholas M, Eustace S, "Anatomy for Diagnostic Imaging", 1st edition, Elsevier Health Sciences, 2011.
4. Allison LA, "Fundamental molecular biology", 3rd edition, John Wiley & Sons, 2021.

Image source: Lab Project, Consultancy Services, Delhi, India (spectro.in)

Image file name: **BIOLOGY FOR ENGINEERS**

22BT852 - BIOPLASTICS AND BIOCOMPOSITES

Hours per week:

L	T	P	**C**
2	0	2	**3**

PREREQUISITE KNOWLEDGE: Environmental Science, Basics of Biology

COURSE DESCRIPTION AND OBJECTIVES:

The course presents the knowledge about the production of an array of high-value materials such as plastics, coatings, adhesives, and composites from agricultural feedstock that are compatible with current industrial manufacturing systems.

MODULE-1

UNIT-1 **6L+0T+6P=12 Hours**

BIOPOLYMERS:

Bioplastics; Types of biopolymers; Types of bioplastics; Starch based, cellulose-based plastics and aliphatic polyesters (PLA, PHB); Polyamides, bio-derived polyethylene and genetically modified bioplastics.

UNIT-2 **10L+0T+10P=20 Hours**

CHARACTERIZATION AND PROCESSING OF BIOPLASTICS:

Bulk analysis methods (XRD, FTIR, DSC, TGA); Surface analysis methods (SEM, TEM, AFM). Mechanical test: wear, friction, flexibility, fatigue; Industrial applications of bioplastics, Environmental impact of Bioplastics.

PRACTICES:

- Characterization of microbial biopolymer using XRD.
- Identification of functional groups of compounds using FTIR.
- Exercise on plotting of graphs using Origin Pro software.
- Production of bioplastics and biocomposites from biological sources.

MODULE-2

UNIT-1 **6L+0T+6P=12 Hours**

BIOCOMPOSITES:

Classification and characteristics of bio composite materials; Biocomposites production using Soybean Oil and Chicken Feathers; Composite theory of fibre reinforcement (short and long fibres, fibres pull out); Polymers filled with estrogenic fillers; Host tissue reactions.

UNIT-2 **10L+0T+10P=20 Hours**

COMPOSITES:

Green composites; Hybrid composites; Composite implants: Mechanics of improved properties by incorporating different elements; Industrial Applications of bio composites – automobiles, railways, aerospace, military, construction andpackaging.

PRACTICES:

- Design of biocomposite materials using biological wastes.
- Design of biocomposite materials using agro waste materials.
- Testing the strength of biomaterials.
- Develop cutleries using bioplastic.

SKILLS:

- Production of biocomposite materials using biological wastes
- Preparation of bio-derived samples for XRD studies
- Analysis of biocomposites using bulk analysis methods

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the principles of microbial technology for the production of bioplastics and biocomposites.	Apply	1	1,2,9,10
2	Evaluate the biomolecular characteristics to design novel and eco-friendly biomaterials.	Evaluate	1	2,3,4,7,9,10
3	Design and develop the production trains for bioplastics and biocomposites.	Design	2	2,3,4,6,7,9,10
4	Develop novel biocomposite materials as an alternative for clean environment and health.	Create	2	3,4,6,7,9,10

TEXT BOOKS:

1. Agrawal C.M., Ong J.L., Appleford M.R., Mani G., "Introduction to Biomaterials: Basic Theory with Engineering Applications", 1st edition, CPU, 2013.
2. Bastioli C, "Handbook of biodegradable polymers", 2nd edition, Smithers Rapra, 2012.

REFERENCE BOOKS:

1. Joyce Y. Wong, Joseph D. Bronzino, Donald R. Peterson, "Biomaterials: Principles and Practices", 1st edition, CRC Press, 2012.
2. Pilla S, "Handbook of Bioplastics and Biocomposites Engineering applications", 1st edition, John Wiley & Sons, 2011.
3. Véronique Migonney, "Biomaterials", 1st edition, Wiley-ISTE, 2014.

Image source: University Expert on Bioplastics and Biocomposites - Aimplas Formación

Image file name: **BIOPLASTICS AND BIOCOMPOSITES**

22BT853 - COMPUTATIONAL BIOLOGY

Hours per week:

L	T	P	**C**
2	0	2	**3**

PREREQUISITE KNOWLEDGE: Basics of Biology and Computers

COURSE DESCRIPTION AND OBJECTIVES:

The course offers the knowledge on current approaches and principles of drug design process and its policies. It helps to learn the different computational drug designing techniques to develop the novel and safe effective drugs which reduce the cost and time of drug discovery process.

MODULE-1

UNIT-1 **6L+0T+6P=12 Hours**

COMPUTATIONAL BIOLOGY AND DATABASES:

Computational tools in biology and medicine; Overview of biological databases; Nucleic acid & protein databases; Primary, secondary, functional, composite, structural classification database, Sequence formats & storage, Access databases, limitations of existing databases.

UNIT-2 **10L+0T+10P=20 Hours**

SEQUENCE ALIGNMENTS:

Local alignment; Global alignment, scoring matrices PAM, BLOSUM, Gaps and penalties, Dot plots, Dynamic programming approach: Needleman and Wunsch Algorithm, Smith and Waterman Algorithm; Heuristic approach: BLAST, FASTA.

PRACTICES:

- Analyzing nucleotide sequence from NCBI.
- Annotating protein sequence from Swiss Prot.
- Construct Dot Plot.
- Perform local alignment using Smithwatermann algorithm.
- Perform global alignment using Needleman Wunsch algorithm.

MODULE-2

UNIT-1 **6L+0T+6P=12 Hours**

GENOME ANALYSIS:

Polymorphisms in DNA sequence; Next Generation Sequencing technologies; Whole Genome Assembly and challenges; Sequencing and analysis of large genomes; Gene prediction; Functional annotation; Comparative genomics; Human genome project.

UNIT-2 **10L+0T+10P=20 Hours**

MOLECULAR MODELING:

Different types of protein chain modelling: *ab initio*, homology, hybrid, loop; Template recognition and alignments; Modelling parameters and considerations; Model analysis and validation; Model optimization; protein folding and model generation; loop generating methods; loop analysis; Analysis of active sites using different methods in studying protein–protein Interactions and Molecular Docking.

PRACTICES:

- ORF prediction by NCBI-ORF finder.
- Gene prediction by Genscan, Genewise, Gene finder.
- Perform homology modeling of a protein using I-**TASSER.**
- Predict protein secondary structure using SOPMA.
- Docking studies by Auto Dock Vina.
- *In silico* determination of exons and introns in a gene.

SKILLS:

- Analyzing biomolecules using suitable databases.
- Predicting different forms of protein structure.
- Evaluation of stable interactions between target protein and ligand using molecular docking.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Integration of computational programme to fetch answers for biosystems.	Apply	1	2,3,5,9,10
2	Analyze pharmacokinetics and pharmacodynamics of drugs.	Analyze	2	2,4,5,7,9,10
3	Develop logical thinking to analyze biological problems.	Create	1	1,2,5,9,10
4	Develop robust programming by implementing dynamic programming skills.	Create	2	2,3,4,5,6,9,10

TEXT BOOKS:

1. Dokholyan NV, "Computational modeling of biological systems: from molecules to pathways", 1st edition, Springer Science & Business Media, 2012.
2. Basant K. Tiwary, Bioinformatics and Computational Biology: A Primer for Biologists, 1st edition, Springer, 2021.

REFERENCE BOOKS:

1. Blossey, Ralf, "Computational biology: a statistical mechanics perspective" 2nd edition, CRC Press, 2020.
2. Robinson PN, Piro RM, Jager M, "Computational exome and genome analysis", 1st edition, CRC Press, 2017.
3. Waterman MS, "Introduction to computational biology: maps, sequences and genomes", 1st edition, Chapman and Hall/CRC, 2018.
4.

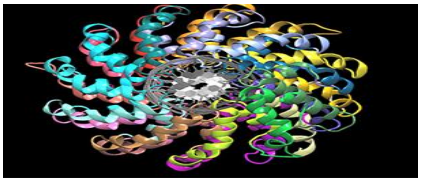

Image source: Structural and Computational Biology | Moleküler Biyoloji, Genetik ve Biyomühendislik (sabanciuniv.edu)

Image file name: **COMPUTATIONAL BIOLOGY**

22BT854 – BIOSENSORS

Hours per week:

L	T	P	C
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Applied physics and Basics of biology

COURSE DESCRIPTION AND OBJECTIVES:

This course offers an insight into the usage of bio-molecules as recognition elements for detection of a particular analyte and biological elements such as proteins in place of silicon chips. It enlightens the types of biosensors, their working principles and applications in various fields. Further it emphasizes on biomolecular computers and its applications.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

TYPES OF BIOSENSORS:

Biosensors - advantages and limitations; various components of biosensors; Bio-catalysis based biosensors; Bio-affinity based biosensors; microorganisms- based biosensors; Biologically active material and analyte; Types of membranes used in biosensor constructions.

UNIT-2 **10L+10T+0P=20 Hours**

TRANSDUCERS:

Various types of transducers; Principles and applications - calorimetric, optical, potentiometric/amperometric, conductometric / resistometric, piezoelectric, semiconductor, impedimetric and chemiluminescence.

PRACTICES:

- Review on analyte detection using bio-catalysis based biosensors in environmentalsamples.
- Report on design of Bio-affinity based biosensors.
- Quiz/debate on commercial diagnostic kits based on biosensors.
- Report on Biosensors in Industrial Process control.

MODULE-2

UNIT-1 **6L+6T+0P=12 Hours**

APPLICATIONS OF BIOSENSORS

Biosensors in clinical chemistry; Medicine and Health care, Veterinary, Agriculture, Food and Environmental monitoring; Low-cost biosensor for industrial processes foronline monitoring; Design of enzyme electrodes and their application as biosensors in industry; CO_2, O_2, NOx and Air particulate sensors.

UNIT-2 **10L+10T+0P=20 Hours**

BIO-MOLECULAR COMPUTERS

Potential advantages and developments towards a biomolecular computer and molecular arrays as memory stores; Molecular wires and switches; Mechanisms of unit assembly, Assembly of photonic biomolecular memory store; Information processing; Commercial prospects for biomolecular computing systems.

PRACTICES:

- Report on applications of biosensors for detection of toxins in food industry.
- Review on the different designs of enzyme electrode.
- Debate on Pesticide detection methods in environment using biosensors.
- Report on Biomolecular computers development worldwide.

SKILLS:

- Immobilization of enzymes and biomolecules on solid platforms.
- Selection of suitable sensing method for detection of specific biomolecules and pathogens.
- Paper based sensors development for detection of analyte.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the principles of biosensors for the development of devices.	Apply	1	1,2,9,10
2	Design biosensors for biomedical applications.	Design	1	2,3,4,5,6,9,10
3	Evaluate different types of transducers for development of biosensors.	Evaluate	2	2,3,5,9,10
4	Develop biosensors for detection of pollutants in environmental samples.	Create	2	2,3,4,5,9,10

TEXT BOOKS:

1. Florinel?Gabriel Banica(auth.), "Chemical Sensors and Biosensors: Fundamentals and Applications", 1st edition, John Wiley & Sons; 2012.
2. Yoon JY, "Introduction to biosensors: from electric circuits to immunosensors", 2nd edition, Springer; 2016.

REFERENCE BOOKS:

1. George K. Knopf and Amarjeet S. Bassi, "Smart Biosensor Technology", 2nd edition, CRC Press, 2019.
2. Ajit Sadana, Neeti Sadana, "Biomarkers and Biosensors: Detection and Binding to Biosensor Surfaces and Biomarkers Applications", 1st edition, Elsevier Science, 2014.
3. Chang W, Vasilakos AV, "Molecular Computing", Springer International Publishing, 1st edition, 2014.

Image source: https://www.behance.net/gallery/13712465/Molecular-Systems-Biology?tracking_source=search_projects%7Csystems%20biology

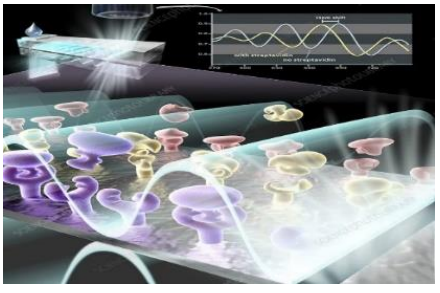

Image file name: BIOSENSORS

22CT851 – BIOREMEDIATION TECHNOLOGIES FOR ENVIRONMENTAL POLLUTANTS

Hours per Week:

L	T	P	**C**
2	0	2	**3**

PREREQUISITE KNOWLEDGE: Basic knowledge on the concept of environment, sustainable development and important environmental issues

COURSE DESCRIPTION AND OBJECTIVES:

This course gives an insight into the environmental problems caused due to various contaminants and various approaches used towards their remediation. The objective of this course is to make the students aware of the various bioremediation technologies available for this purpose and make them develop novel ideas for creating novel bioremediation technologies and strategizing their implementation process.

MODULE-1

UNIT-1 **8L+0T+8P=16 Hours**

ENVIRONMENTAL POLLUTANTS:

Global environmental problems; Environmental pollutants; Solid wastes; Hazardous wastes; Radioactive wastes; Xenobiotics; Environmental pollution control and remediation methods and technologies (air purification methods, wastewater treatment technologies, soil abatement methods etc.).

UNIT-2 **8L+0T+8P=16 Hours**

POLLUTION DETECTION:

Analytical methods for determining and monitoring environmental pollutants/contaminants - collection of samples, characterization of samples; Instrumentation used for analysis (AAS, HPLC, Spectrophotometry, GCMS, ICP spectroscopy etc.) - principles and working methodology; Toxicity analysis.

PRACTICES:

- Visit to a sewage treatment plant.
- Wastewater analysis.
- Stack monitoring and air pollution analysis through mathematical modelling.
- Soil sample analysis, Organic Carbon, NPK determination.
- Instrumentation training (Instruments used for environmental sample analysis).

MODULE-2

UNIT-1 **8L+0T+8P=16Hours**

BIOREMEDIATION PROCESSES:

Bioremediation; Types of bioremediations (microbial remediation, phytoremediation entomoremediation etc.); Biodegradation of pollutants; Bioaugmentation; Biomagnification; Biotransformation; Bioventing; Biosorption; Biomonitoring.

UNIT-2 **8L+0T+8P=16 Hours**

BIOREMEDIATION TECHNOLOGIES:

Biofilm processes; Bioremediation of air, water, soil samples; Bioremediation of metals (mechanism of metal adsorption and remediation, arsenic remediation); Advanced phytoremediation techniques; Sequestration of CO_2; Application of microbial enzymes for bioremediation; Use of bioadsorbents for waste eater remediation; Adsorption studies; Bioremediation of radioactive wastes.

PRACTICES:

- Practicing basic microbiology techniques (media preparation, pour plating, streaking etc.) and instrumentation (autoclaving, using laminar airflow etc.).
- Isolation and molecular identification of microorganisms.
- Identification of plants used for phytoremediation.
- Bioremediation studies of organic pollutants and polymers.
- Bioadsorbent preparation and adsorption of dyes/metals/fluorides/PAH etc. from wastewater.
- Design implementation strategies for waste management through bioremediation approaches.

SKILLS:

- Develop environmental pollution detection methods.
- Design various pollution determining kits for easy detection of chemical contaminants.
- Develop bioremediation techniques for pollutant removal.
- Strategize novel routes for bioremediation technology implementation.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the basic concepts of environmental chemistry for the purpose of environmental protection.	Apply	1	1,2,7,9,10, 11, 12
2	Apply various bioremediation techniques for abatement of environmental pollution.	Apply	2	1,2,3,4,5,7,9, 10, 11, 12
3	Analyze environmental contamination by use of various analytical techniques.	Analyze	1	1, 2,4,7,9, 10,11,12
4	Recommend various bioremediation approaches and formulate their implementation strategies	Evaluate	2	1,2,6,7,9,11, 12

TEXT BOOKS:

1. S. E. Manahan, "Environmental Chemistry", CRC Press, 10th Edition, 2017.
2. M. Prashanthi, R. Sundaram, "Bioremediation and Sustainable Technologies for Cleaner Environment (Environmental Science and Engineering)", CRC press, Springer; 1st Edition, 2017.

REFERENCE BOOKS:

1. S. C. Bhatia, "Solid and Hazardous Waste Management", Atlantic Publishers and Distributers (P) Ltd, 2021.
2. E. Hinchee, R. N. Miller, P. C. Johnson, "In Situ Aeration: Air Sparging, Bioventing, and Related Remediation Processes", Eds. Robert, Battelle Press, 1995.

3. W. Chang (Ed), “Biodegradation and Bioremediation: Pollution Control and Waste Management”, Callisto Reference, 2019.
4. G. Saxena, V. Kumar, M. P. Shah, “Bioremediation for Environmental Sustainability: Toxicity, Mechanisms of Contaminants Degradation, Detoxification and Challenges”, Elsevier, 1st Edition, 2020.
5. E. R. Donati, “Heavy Metals in the Environment: Microorganisms and Bioremediation”, Edgardo R. Donati, CRC Press, 1st Edition, 2018.

Image source: Sewage Treatment Plant (STP) at VFSTR

Image file name: **22CT851 – BIOREMEDIATION TECHNOLOGIES FOR ENVIRONMENTAL POLLUTANTS**

22CT852 - CHEMISTRY FOR EMERGING TECHNOLOGIES

Hours per Week:

L	T	P	**C**
2	0	2	**3**

PREREQUISITE KNOWLEDGE: Concept of reaction mechanism, basic computer skills

COURSE DESCRIPTION AND OBJECTIVES:

This course aims to emphasize the importance of emerging technologies of chemistry in engineering disciplines. In addition to gaining knowledge on some of the advanced technologies in chemistry the students are expected to learn contemporary environmental and information technology driven advanced topics, such as turning plastics in to monomers, molecular motors, artificial intelligence in chemistry and rapid diagnostics particularly relevant for their respective engineering branches.

MODULE-1

UNIT-1 **8L+0T+8P=16 Hours**

TURNING PLASTICS INTO MONOMERS:

Introduction to polymers; Types of polymers; Depolymerization; Degradation techniques - Biodegradable polymers and environmental prospect.

UNIT-2 **8L+0T+8P=16 Hours**

MOLECULAR SWITCHES:

Characteristics of molecular motors and machines; Rotaxanes and catanenes as artificial molecular machines prototypes - linear motions in rotaxanes, an acid-base controlled molecular shuttle, a molecular elevator, an autonomous light powered molecular motor.

PRACTICES:

- Synthesis of polymers.
- Design principles of degradation technologies.
- Characterization of monomers formed from polymers.
- Synthesis of rotaxane.
- Crystallization of rotaxanes.
- Acid base controlling of rotaxanes.

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

ARTIFICIAL INTELLIGENCE APPLIED TO CHEMISTRY:

Introduction; Molecular property predictions; Quantitative structure activity relationships; Molecule design and retrosynthesis; Chemical reaction optimization.

UNIT-2 **8L+0T+8P=16 Hours**

RAPID DIAGNOSTICS FOR TESTING:

Immunochromatographic tests; Specimen types; Pathogens; Types of diagnostics; Rapid diagnostics - types, limitations, response time.

PRACTICES:

- Development of retrosynthetic scheme of natural product.
- Molecular property prediction from structure.
- Reaction optimization.
- Rapid diagnostics of malaria, Typhoid.
- Response time calculation.

SKILLS:

- Identify avenues to degrade the plastics.
- Recognize the potential of molecular motors and their light driven shuttle.
- Understand the applications of artificial intelligence in chemical industry.
- Analyze several rapid diagnostics.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply various synthetic techniques for the preparation of biodegradable polymers.	Apply	1	1, 2, 6, 7, 9, 10, 11, 12
2	Identify recent developments in the areas of molecular switches for specific applications.	Apply	1	1, 2, 3, 6, 9, 10, 11, 12
3	Analyze various properties of molecules and reaction parameters utilizing basic concepts of artificial intelligence.	Analyze	2	1, 2, 3, 4, 5, 6, 9, 10, 11, 12
4	Assess the suitability of various types of diagnostic testing.	Analyze	2	1, 2, 5, 6, 7, 8, 9, 10, 11, 12

TEXT BOOKS:

1. M. Sharma, “Biodegradable Polymers: Materials and their Structures”, CRC Press, 2021.
2. B. L. Feringa, W. R. Browne, “Molecular Switches”, Vol. 1,Wiley-VCH,, 2011.

REFERENCE BOOKS:

1. H. M Cartwright (Ed.), “Machine Learning in Chemistry: The Impact of Artificial Intelligence”, Royal Society of Chemistry, 2020.
2. L. Anfossi, “Rapid Test - Advances in Design, Format and Diagnostic Applications”, Intechopen, 2018.
3. M. Chanda (Ed.), “Introduction to Polymer Science and Chemistry, A Problem-Solving Approach", CRC Press, 2013.
4. J.P. Sauvage, C. Dietrich-Buchecker, “Molecular Catenanes, Rotaxanes and Knots: A Journey Through the World of Molecular Topology”, Wiley-VCH, 1999.
5. S. Saxena, “Proof and Concepts in Rapid Diagnostic Tests and Technologies”, InTechOpen, 2018.

Image source: https://news.mit.edu/2022/generating-new-molecules-with-graph-grammar-0401

Image file name: **22CT852 - CHEMISTRY FOR EMERGING TECHNOLOGIES**

22CT853 – CHEMISTRY IN DAILY LIFE

Hours per Week:

L	T	P	**C**
2	0	2	**3**

PREREQUISITE KNOWLEDGE: Basic understanding of chemistry at intermediate level

COURSE DESCRIPTION AND OBJECTIVES:

This course enables to understand the structural, functional significance of essential elements of life. It creates awareness on usage of natural substances and the consequences resulting from the artificial substances. Topics of this course include the chemistry behind many of the substances in regular usage for cleaning, to consume as food, to use for our daily routine and to sustain with elements of life. It also allows the students to be familiar with the nutritional components present in basic food substances. It elaborates the chemistry of cosmetics and how they act on our body. It enlightens and brings awareness on different components used in food industry. It offers theoretical knowledge about the manufacturing procedure of certain daily life materials.

MODULE-1

UNIT-1 **8L+0T+8P=16 Hours**

MATTER & LIFE:

Air we breathe: Composition of air; Role of Oxygen in body-its transport - saturation level and consequences due to fluctuations in it.

Soil we live: Physical and chemical properties of soil; Link between soil and organism; Ingestion, digestion and cycling nutrients and organisms by soil.

Water we drink: Standard parameters of potable water; Municipal water treatment for drinking purpose.

Fire & fuels: History of fire and fuels; Fuel characteristics & specifications for domestic, automobile, aircraft, ships and sub marines.

UNIT-2 **8L+0T+8P=16 Hours**

CHEMISTRY OF CLEANING AGENTS & COSMETICS:

Composition and cleaning action of tooth paste, soap, detergents, shampoo, floor cleaners, dish washing/glass cleaning chemicals, disinfectants.

Composition and response of each component in sun screen lotion, moisturizer, compact powder, fairness cream, lipstick, kazal and hair dye.

PRACTICES:

- Study of oxygen saturation in normal and lung infected /diseased persons.
- Identifications of various types of soils.
- Study on how plastic waste declines water percolation capacity and leading to floods.
- Different fuels and their calorific values – fitness as fuel.
- Study the degree of harm caused by the usage of cleaning chemicals in excess-suggest natural/organic substitute for these.
- Study the degree of harm caused by application of cosmetics more frequently -suggest natural/organic substitute for these.

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

FOOD CHEMISTRY & NUTRITION:

Elements in human body, what is food for thought? - Balanced diet, components in coffee, tea, milk and beverages. Sources and role of carbohydrates, proteins and fats in sound health.
Minerals, vitamins, antioxidants in various foods and their role in healthy maintenance of body.
Artificial components in food- preservatives, coloring agents, binding substances, flavoring agents, foaming agents, flow stabilizers. Artificial sweeteners – their impact on health.

UNIT-2 **8L+0T+8P=16 Hours**

MANUFACTURING CHEMISTRY:

Chemistry behind manufacturing of salt, sugar, jaggery, coffee powder, tea powder, edible oils, paper, printing ink, textile & dyes.

PRACTICES:

- Prepare your own diet chart for good health based on your BMI and existing health conditions.
- Prepare a protocol to minimize the usage of junk food among children & youngsters - to build up a healthy community in future.
- Prepare flow sheets for the manufacturing procedure of most commonly used substances like protein powder, soup powder.
- What principles do you follow while selecting raw materials for the manufacturing of a substance? How do you minimize wastage? – sustainable practices & green chemistry from the visit to one or two industries.

SKILLS:

- Find the break point chlorination of water from various resources to make it potable.
- Check the purity of different fuels from their calorific values.
- Prepare a cost-effective protein powder to feed malnourished children below poverty line and justify its function.

COURSE OUTCOMES

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the alternative methods and study their impact in restoring the essential components of nature clean and safe.	Apply	1	1,2,6, 7, 8,12
2	Analyze the composition of cleaning agents & cosmetics.	Analyze	1	1, 2,3,6, 7,9,10,11, 12
3	Assess the chemistry of human body chemistry and its nutrient requirements.	Analyze	2	1, 2,6, 7, 8,12
4	Evaluate the positive and negative responses from the addition of various food additives in the food products with respect to dietary intake and metabolism.	Evaluate	2	1,2,3,4,6, 7, 8, 12

5	Examine the manufacturing protocols for the preparation of commonly used substances in daily life.	Evaluate	2	1, 2,3,4,6, 7, 8, 12

TEXT BOOKS:

1. G. D. Gem Mathe, "Chemistry In Everyday Life", Vishal publication, 2nd Edition, 2022.
2. A. Kwatra, "Wonder Chemistry: How Can You Relate Chemistry in Your Day-to-Day Life Experiences", Xpress publishing, 1st Edition, 2020.

REFERENCE BOOKS:

1. S. Kisalaya, "Chemistry in Everyday Life", Discovery Publishing Private Limited, 1st Edition, 2011.
2. K. Singh, "Chemistry in Daily Life", PHI Learning Pvt. Ltd., 3rd Edition, 2012.
3. N. Morgan, "Chemistry in action: the molecules of Everyday Life", Illustrated Edition, Oxford University Press, 2003.

Image source: https://www.brainkart.com/article/Chemistry-in-Everyday-life_43142/

Image file name: **22CT853 – CHEMISTRY IN DAILY LIFE**

22CT854 - COMPUTATIONAL CHEMISTRY

Hours per Week:

L	T	P	**C**
2	0	2	**3**

PREREQUISITE KNOWLEDGE: Basic computer knowledge, experience in Chemdraw / Chemsketch, basic knowledge of Biochemistry, organic chemistry and physical chemistry

COURSE DESCRIPTION AND OBJECTIVES

The course is designed to address the computer-aided calculations within chemistry. The course integrates theory with practical computation elements applied within the fields of organic chemistry, protein chemistry and medicinal chemistry. The students are expected to acquire knowledge within quantum chemistry, molecular mechanics, and the theoretical characterization of molecules, and applied methods of computation for the electronic structure of molecules. The course is comprised of theory as well as practical applications within quantum chemistry based on quantum mechanics.

MODULE 1

UNIT-1 **8L+8T+0P=16 hours**

APPROXIMATION AND DFT FUNCTIONALS:

Review of Classical Mechanics; Introduction to Quantum Mechanics; Wave function and properties; Operators; Eigen value and Eigen function; Born-Oppenheimer approximation; Hohenberg-Kohn theorems; Hohenberg-Kohn sham theorems; Particle in 1D, 2D, 3D box, and Transition state theory.

UNIT-2 **8L+ 8T+0P=16 hours**

APPROXIMATION AND OPTIMIZATION:

Approximations for exchange-correlation - Local Density Approximation (LDA), Generalized Gradient Approximation (GGA), various Hybrid functionals, meta-GGA functionals, DFT functionals.

Slater determinant; Introduction to computational chemistry - introduction to basis set, dielectric constant, solvation models, local and global optimization, cartesian coordinates and z-matrix for hydrogen molecule.

PRACTICES:

- Demo and practice (Chemdraw/Chemsketch and Gaussview).
- Drawing the chemical structures using Chemdraw/Chemsketch.
- Designing of Cartesian coordinates for methane to decane and any five aromatic compounds.
- Energy minimization of molecules in chemdraw/Chemsketch.
- Learn the various file format while saving chemical structures using chemdraw like .mol, .sdf, .pdb, mol2, .gjf, .com and understand their difference.
- Draw the chemical structure using Gauss view and save it in the format of Cartesian coordinates, z-matrix. Learn the difference between two formats.

MODULE - 2

UNIT-1 **8L+8T+0P=16 Hours**

OPTIMIZATION OF SMALL MOLECULES:

Amino acids- Classification, physico-chemical properties, Organizational structure of protein structure, microsolvation, frontier molecular orbital (FMO) structure and its calculation, Time-Dependent Density functional theory.

UNIT-2 **8L+8T+0P=16 Hours**

PURINES, PYRIMIDINES AND BEYOND:

Structure and properties of purines and pyridimines, Nucleotides and Nucleosides, Biosynthesis and degradation of purines and pyrimidines; DNA double helix structure, DNA mutation and its effect, Transcription and Translation.

PRACTICES:

- Prepare an input file for Glycine, Purines, pyrimidines and other given organic molecules for optimizing the strucutres using Gaussian suite of program.
- Set the parameters in Gaussian software and optimize various given structure. Note down the total energy of the system. Understand the various total energy for different systems.
- Calculate the binding energy of the complex using total energy and Gibbs free energy, independently. Note down the differences, if any.
- Find out the activation energy for SN 2 reaction using Gaussian suite of program. Write down the bond angle of Walden inversion in the TS.
- Draw the chemical structure of various DNA mutated structures and allow them to interact with respective purines and pyrimidines and find out the binding energy, enthalpy, Gibbs free energy, hydrogen bonding lengths (Strong and weak). Report the strong and weak hydrogen bonding.
- Execute the microsolvation for any one of the aminoacids with zwitterion until reach the isoenergetic structure.
- Draw the potential energy diagram after certain calculation using Gaussian for the given organic reaction.
- Choose the write DFT method with basis set for the given gas phase calculation.

SKILLS:

- Gain basic knowledge of Chemdraw / Chemsketch tools.
- Understand the need of computational chemistry.
- Calculate the binding energy for various complexes.
- Able to use various software for the application of chemistry.
- Design and investigate the organic reaction mechanism.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Recognize the potential applications of computational chemistry.	Apply	1	1, 2, 3, 5, 9, 10, 11, 12
2	Apply various computational methods for different chemical problems	Apply	1	1, 2, 3, 5, 6, 9, 10, 11, 12

3	Analyze various solvation methods for optimization.	Analyze	2	1, 2, 5, 9, 10, 11, 12
4	Identify the suitable DFT method for a given reaction mechanism	Evaluate	2	1, 2, 5, 6, 7, 8, 9, 10, 11, 12
5	Utilize computational methods to study properties of molecules and materials	Create	2	1,2, 4, 5, 6, 7, 8, 10, 11, 12

TEXT BOOKS:

1. F. Jensen, "Introduction to Computational Chemistry", Wiley-VCH, 3rd Edition, 2018.
2. C. Cramer, "Essential of Computational Chemistry", Wiley-VCH, 2nd Edition, 2004.

REFERENCE BOOKS:

1. Gaussian Software Manual, 2016.
2. M. S. Pathania, B.R. Puri, L.R. Sharma, "Principles of Physical Chemistry", Vishal Publishing, 2020.
3. P. Atkins, J. de Paula, J. Keeler, "Atkin's Physical Chemistry", Oxford, 2018.
4. A. K. Chandra, "Introductory Quantum Chemistry", McGraw-Hill, 2004.

Image source: https://www.h-its.org/teachings/applied-computational-chemistry/

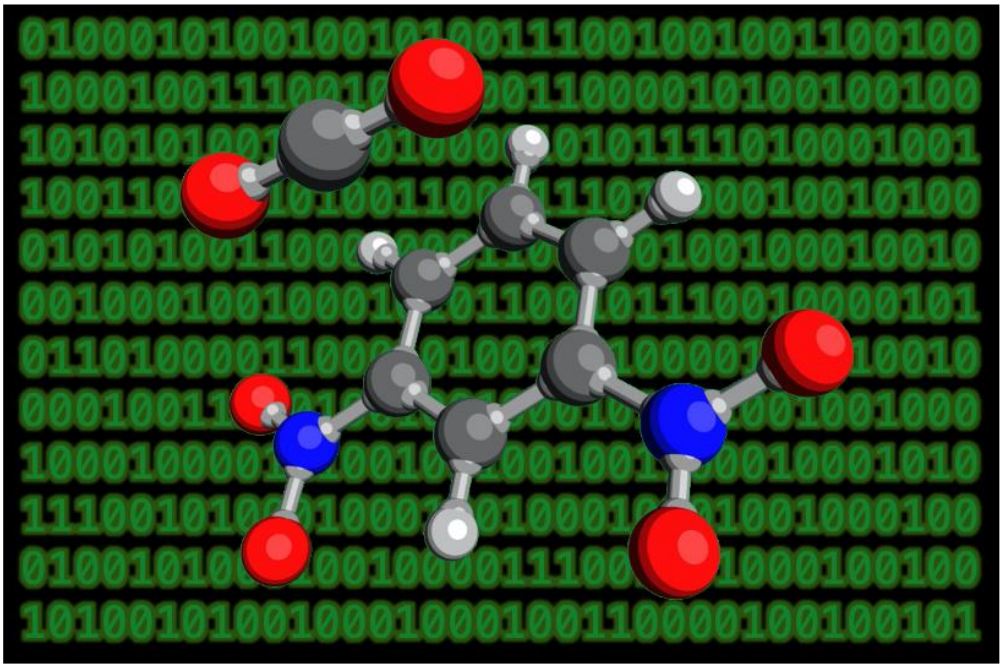

Image file name: **22CT854 - COMPUTATIONAL CHEMISTRY**

22CT855 – ELECTROCHEMICAL ENERGY CONVERSION AND STORAGE

Hours per Week:

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basics of electrochemical cells, electrodes, concepts of oxidation and reduction, voltage and current

COURSE DESCRIPTION AND OBJECTIVES:

This course covers the basic theory and application of electrochemistry. It is targeted toward students who want to better understand electrochemical processes or to add electrochemical methods to their repertoire of research approaches, including both those who have not yet had much formal electrochemical training and those with more experience. The course starts at a basic level to ensure that each student starts on a solid footing and to dispel common misconceptions. It then progresses to cover the core of electrochemical theory that forms the basis for the techniques that are detailed later in the course. Practical examples, diagrams and images illustrate and reinforce the subject matter.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

FUNDAMENTAL MEASUREMENTS IN ELECTROCHEMISTRY:

Types of Electrochemical Cells; Electrode potential, Nernst equation – applications; electrochemical series; Thermodynamics of electrochemical cells and applications; Polarizable and non-polarizable electrodes; Types of reference and working electrodes; Choice of reference electrodes.

UNIT-2 **8L+8T+0P=16 Hours**

ELECTRODE KINETICS:

Current-Potential Relationship using Butler-Volmer and Tafel equations; Types of overpotential and their minimization; Types of diffusion of electroactive species; Hydrogen Evolution Reaction (HER); Oxygen Evolution/Reduction Reaction (OER/ORR); Transition State Theory and Gibbs Free Energy of Activation.

PRACTICES:

- Construction of an electrochemical cell.
- Construction of a non-aqueous reference electrode.
- Estimation of thermodynamic parameters of an electrochemical cell.
- Study the reversibility of a redox system.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

ENERGY CONVERSION/STORAGE SYSTEMS:

Fuel cells (Hydrogen-Oxygen, Microbial Fuel Cell, and Solid Oxide Fuel Cell); Dye-sensitized solar cells; Batteries - Lead-Acid battery, Lithium-Ion battery, Zn-Air battery; Supercapacitor.

UNIT-2 **8L+8T+0P=16 Hours**

EXPERIMENTAL TECHNIQUES:

Cyclic Voltammetry; Linear Sweep Voltammetry; Chronopotentiometry; Chronoamperometry; Electrochemical Impedance Spectroscopy; Nyquist and Bode Plot; Randle's circuit; Fitting of impedance spectra with suitable circuit.

PRACTICES:

- Construction of paper-based micro-fuel cell.
- Determination of anodic and cathodic current using cyclic voltammetry.
- Determination of resistance of a resistor using linear sweep voltammetry.
- Determination of resistance and capacitance from an impedance circuit fit.

SKILLS:

- Understand the different components of an electrochemical cell.
- Learn fundamentals of the relationship between current and potential.
- Design electrochemical cell for example, battery.
- Identify the types of energy conversion/storage systems.
- Choose the appropriate experimental technique to characterize the energy conversion/storage systems.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Formulate equations representing electrochemical cell and construct various reference electrodes using electrochemistry concepts.	Apply	1	1, 2, 9, 10, 11, 12
2	Devise various electrochemical energy conversion/storage systems by applying the basic electrochemistry principles.	Apply	2	1, 2, 3, 5, 6, 7, 9, 10, 11, 12
3	Analyze various overpotential involved during operation of the cell to understand the kinetics of electrochemical reactions.	Analyze	1	1, 2, 3, 5, 9, 10, 12
4	Apply the knowledge of electrochemistry to analyze real-time electrochemical processes using various experimental techniques.	Analyze	2	1, 2, 3, 4, 9, 10, 12

TEXT BOOKS:

1. E. Gileady, "Physical Electrochemistry, Fundamental, Techniques and Applications", Wiley-VCH, 2011.
2. J. Bard, L. R. Faulkner, "Electrochemical Methods: Fundamentals and Applications", Wiley-VCH, 2nd Edition, 2001.

REFERENCE BOOKS:

1. J. Newman, K. E. Thomas-Alyea, "Electrochemical Systems", Wiley Interscience, 3rd Edition, 2004.
2. J. Wang, "Analytical Electrochemistry", Wiley-VCH, 2nd Edition, 2000.

3. M. E. Orazem, B. Tribollet, “Electrochemical Impedance Spectroscopy”, A. John Wiley & Sons, Inc., Publication, 2008.

Image source: https://chemistry-europe.onlinelibrary.wiley.com/doi/10.1002/batt.202100078

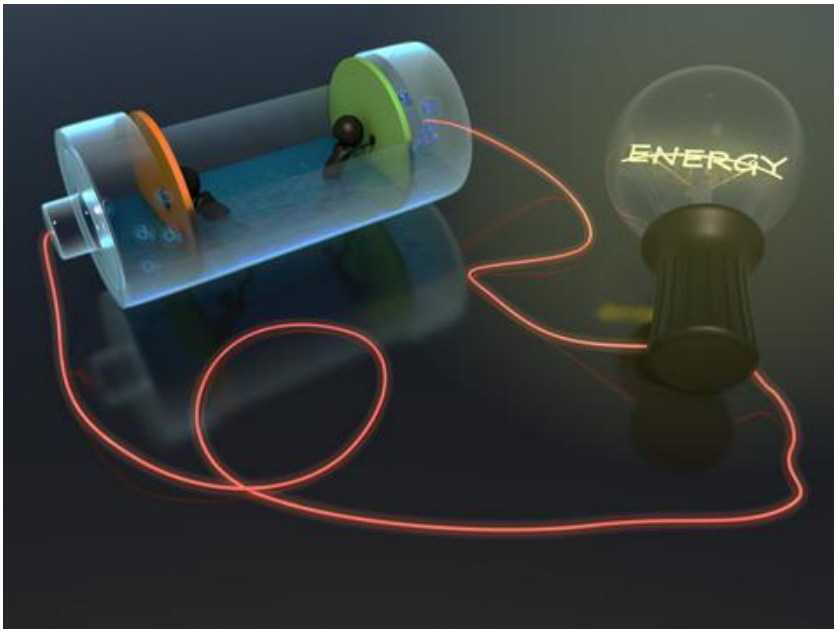

Image file name: **22CT855 – ELECTROCHEMICAL ENERGY CONVERSION AND STORAGE**

22CT856 – ELECTRONIC AND OPTOELECTRONIC POLYMERS

Hours per Week:

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Concept of electrochemistry, polymer synthesis, conductors, semiconductors, and insulators

COURSE DESCRIPTION AND OBJECTIVES:

This course aims to highlight the importance of electronic and optoelectronic polymers and its advanced applications in communication systems, light emitting diodes, electronic and energy devices, artificial nerves, electromechanical actuators, and magnetic resonance imaging etc. This course particularly suitable for electronic and communication, electrical and electronics, mechanical and chemical engineering disciplines. In addition to gaining knowledge on synthesis and physico-chemical properties of electronic and optoelectronic polymers, students are expected to learn NMR spectroscopy, Nanomaterials and Gaussian Software.

MODULE 1

UNIT-1 **8L+8T+0P=16 Hours**

ELECTRONIC POLYMERS:

Chemistry and concept of electronic polymers; Electronic small molecules and electronic nanocomposites; Electrodepositable resists and resins; Photoconductive polymers; Magnetic polymers; Thermosensitive polymers; Liquid crystalline polymers.

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATIONS OF ELECTRONIC POLYMERS:

Rechargeable batteries, Sensors, EMI shielding, Printed Circuit Boards, Artificial nerves, Electromechanical actuators, and Switches; Magnetic resonance imaging applications; LC polymer based (unreinforced and reinforced) fibers. Biodegradable Polymer Nanocomposites for Electronics.

PRACTICES:

- Degradation of organic and inorganic contaminates present in chlorinated solvents and water sources by using Iron.
- Synthesis of oligo (ethylene glycol) methacrylates.
- Synthesis of PLA via ring-opening polymerization and characterization by using ^{1}H NMR.
- Synthesis of PCL via ring-opening polymerization and characterization by using ^{1}H NMR.
- Construction of rechargeable bio-battery cells from electroactive antioxidants extracted from wasted vegetables (Report submission).

MODULE 2

UNIT-1 **8L+8T+0P=16 Hours**

OPTOELECTRONIC POLYMERS:

Conducting Polymers - Conducting mechanisms – Electron transport and Bipolar polymers; Electronic Structure and Doping in Conjugated Polymers; Methods for Preparation of Conjugated Polymer; Polymer Solar Cells – Architecture, Morphology and Characterization of Polymer Solar Cells, Novel Acceptor Materials.

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATIONS OF OPTOELECTRONIC POLYMERS:

Organic Light Emitting Diodes (OLEDs); Organic Field Effect Transistors (OFETs); Organic Photovoltaics (OPVs); Functional polymers for optoelectronic applications by RAFT polymerization; Designing Conjugated Polymers for Photovoltaic Applications, Optimization of HOMO-LUMO Energy levels and Optical band gaps for polymer based Organic Solar cells.

PRACTICES:

- Optimization of simple organic molecules by using Gaussian Software.
- Optimization of HOMO-LUMO Energy levels for optoelectronic polymers using Gaussian software.
- Synthesis of polyaniline and measurement of electrical conductivity.
- Synthesis of polythiophene and measurement of electrical conductivity.
- Preparation of functional polymers by RAFT Polymerization method. (Synthesis or report submission).

SKILLS:

- Able to design and synthesize various novel electronic and optoelectronic polymers.
- Hands on experience on handling Gaussian software.
- Able to predict plausible conduction mechanisms based on various characterization techniques learned.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the fundamental knowledge of electronic polymers to create new polymeric materials.	Apply	1,2	1, 2, 3, 6, 9, 10 12
2	Design the novel conducting & bio-based polymers for optoelectronic applications.	Apply	1, 2	1, 2, 3, 4, 6, 7, 9, 10, 12
3	Analyze the proficiencies of various polymer electronics.	Analyze	1,2	1, 2, 3, 4, 6, 9, 10, 12
4	Evaluate the properties of various OLEDs, OPVs and Optimized conditions pre-requisite for designing novel optoelectronics.	Evaluate	1, 2	1, 2, 3, 4, 6, 7, 9, 10, 12

TEXT BOOKS:

1. N. K. Subramani, H. Siddaramaiah, J. H. Lee, "Polymer-Based Advanced Functional Composites for Optoelectronic and Energy Applications", Elsevier, 1st Edition, 2021.
2. G. Wypych, "Handbook of Polymers for Electronics", 1st Edition, 2021,

REFERENCE BOOKS:

1. S. Khalifeh, "Polymers in Organic Electronic" Elsevier, 2020.
2. M. Geoghegan and G. Hadziioannou, "Polymer Electronic, Volume 22", Oxford Master Series in condensed matter physics, 2013.
3. W. Clemens, "Polymer Electronics" in Bullinger, HJ. (Eds) Technology Guide. Springer, Berlin, Heidelberg, 2009.

4. Y. Wang, “Photoconductive Polymers in Kirk-Othmer Encyclopedia of Chemical Technology”, Wiley-VCH, 2000.
5. H-F, Meng, “Polymer Electronics in Polymer Science and Technology”, Pan Stanford 2013.

Image source: https://lairdthermal.com/applications/optoelectronics

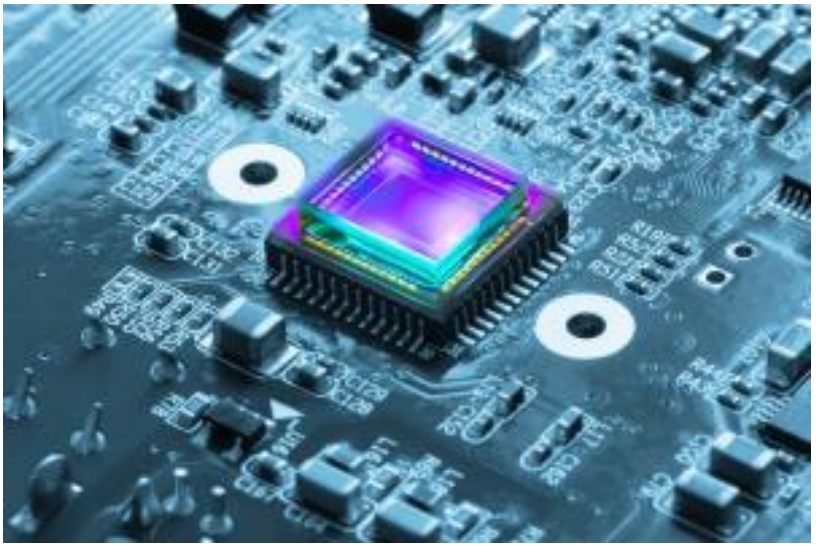

Image file name: **22CT856 – ELECTRONIC AND OPTOELECTRONIC POLYMERS**

22CT857– NANOBIOTECHNOLOGY

Hours per Week:

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basics of chemistry, physics and biology

COURSE DESCRIPTION AND OBJECTIVES:

This course aims to focus on the fundamental aspects of nanomaterials and its applications biotechnology. It is primarily designed for undergraduate students who have interest in this rapidly expanding exciting area. In the first module, students are expected to get fundamental ideas about nanomaterials including their classification, syntheses, and properties. Once the stage is set for the students, the second module of the course covers applications nanomaterials in biotechnology. The course is designed to be more interactive with active participation from the students with occasional lab practices.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

FUNDAMENTALS OF NANOMATERIALS:

Definition of nanomaterials; History of nanomaterials; Different classification schemes of nanomaterials; Metal and metal-based nanomaterials; Carbon-based nanomaterials; Various applications of nanomaterials; Introduction of nanobiotechnology.

UNIT-2 **8L+8T+0P=16 Hours**

SYNTHESES AND CHARACTERIZATION OF NANOMATERIALS:

Syntheses of nanomaterials - top-down and bottom-up approaches (minimum two examples in details from each category) - biological and green synthesis of nanomaterials.

Important Characterization techniques – microscopy (SEM and TEM), X-ray-based techniques (PXRD and XPS), UV and IR spectroscopy, surface area analysis.

PRACTICES:

- Students' survey on the use of nanomaterials at their homes and university.
- A well-researched review on the nanomaterial assigned to each group.
- Synthesis of metal-oxide nanomaterials using sol-gel.
- Synthesis of noble-metal nanoparticles using biological processes.
- Characterization of the as-synthesized nanoparticles using various characterization techniques available at Center of Excellence.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

NANOMEDICINES:

Introduction of nanomedicines; Different types of drug-delivery systems; different strategies for loading of drugs and their controlled release; Recent examples and current challenges of nanomedicines, Introduction to nanobiomaterials (with examples).

UNIT-2 **8L+8T+0P=16 Hours**

BIOIMAGING AND BIOSENSING TECHNIQUES:

Concept of bioimaging and biosensing; Colorimetric and electrochemical sensing; Immunofluorescent biomarker Imaging; Immunogold labeling; Optical nanosensors for intracellular imaging; Cancer imaging.

PRACTICES:

- Study of adsorption of drugs on nanoparticles and fitting of adsorption data onto different isotherm models.
- Study of desorption of adsorbed drugs from the surface of nanomaterials and fitting of desorption data onto different desorption models.
- Preparation of nanosorbate from bio/waste-derived precursors and adsorption study of drug/dye molecules.
- A well-researched review on the use of various nanomaterials (assigned to each group) for biotechnological applications.
- Colorimetric sensing using Au nanoparticles.
- Design of a nanosensor for identification of simple biomolecules such as glucose.

SKILLS:

- Understand uniqueness of nanomaterials.
- Design synthetic strategies of nanomaterials.
- Apply instrumental techniques for characterization of nanomaterials.
- Asses the utility of nanomaterials in drug-delivery applications.
- Identify the importance of nanomaterials for biosensing and bioimaging applications.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the basic science concepts to various nanomaterials and their relevance in biotechnology.	Apply	1	1, 2, 6, 7, 9, 10, 11, 12
2	Identify specific synthetic strategies and characterization techniques of various nanomaterials.	Analyze	1	1, 2, 3, 5, 9, 10, 11, 12
3	Assess the potential of nanomaterials for drug delivery and nanomedicine applications.	Analyze	2	1, 2, 5, 6, 7, 9, 10, 11, 12
4	Evaluate nano-sensing and -imaging techniques for biotechnological applications.	Evaluate	2	1, 2, 3, 5, 6, 9, 10, 11, 12

TEXT BOOKS:

1. T. Pradeep, “A Textbook of Nanoscience and Nanotechnology” McGraw-Hill, 2017.
2. C. Nicolini, “Nanobiotechnology & Nanobiosciences” Pan Stanford Publishing Pvt. Ltd, 2019.

REFERENCE BOOKS:

1. C. A. Mirkin and C. M. Niemeyer, “Nanobiotechnology- II, More Concepts and Applications”, WILEY-VCH, Verlag Gmb H&Co, 2007.
2. N. H. Malsch, “Biomedical Nanotechnology”, CRC Press. 2005.
3. C. S. S. R. Kumar, J. Hormes, and C. Leuschner, “Nanofabrication Towards Biomedical Applications: Techniques, Tools, Applications, and Impact”, WILEY -VCH Verlag GmbH & Co. 2005.
4. A. Lamprecht, “Nanotherapeutics: Drug Delivery Concepts in Nanoscience”, Pan Stanford Publishing Pte. Ltd. 2009.
5. K. K. Jain, “The Handbook of Nanomedicine”, Humana press. 2008.

Image source: https://images.routledge.com/common/jackets/amazon/978149872/9781498721424.jpg

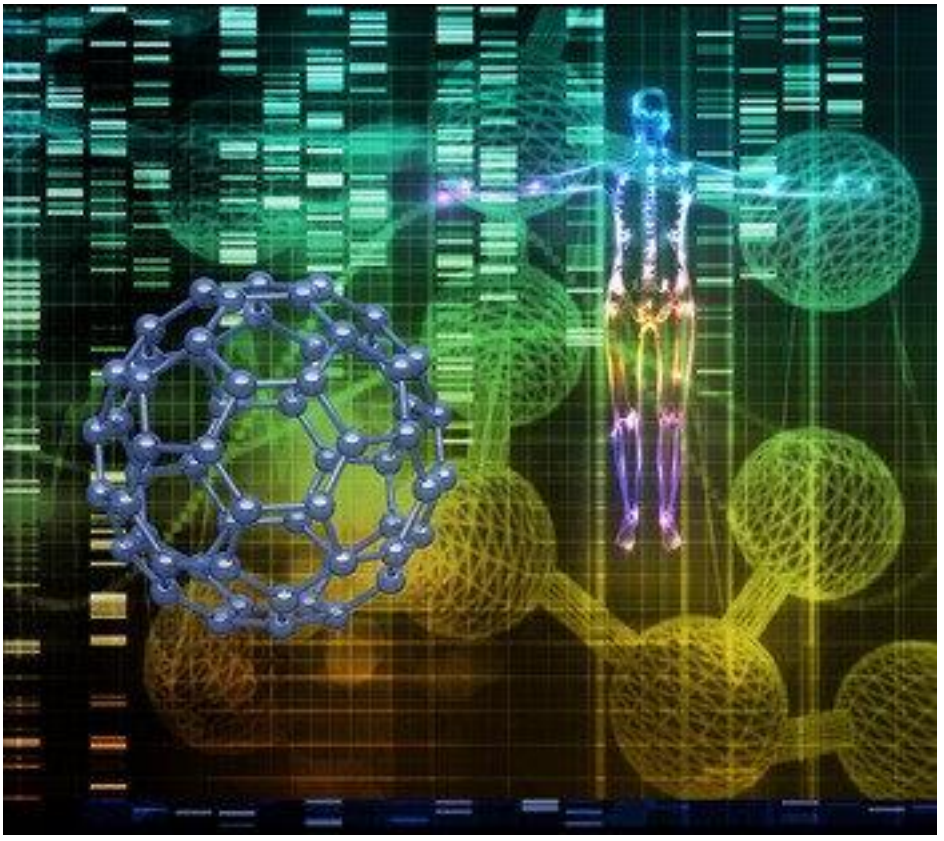

Image file name: **22CT857– NANOBIOTECHNOLOGY**

22CT858 – NANOSCIENCE AND TECHNOLOGY

Hours per Week:

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basic knowledge in chemistry and physics from intermediate level

COURSE DESCRIPTION AND OBJECTIVES:

This course aims to focus on the fundamental aspects of nanomaterials and its applications. It is primarily designed for undergraduate students who have interest in this rapidly expanding exciting area. In the first module, students are expected to get fundamental ideas about nanomaterials including their classification, syntheses, and properties. Once the stage is set for the students, the second module of the course covers the properties of nanomaterials and correlate with their specific applications. The course is designed to be more interactive with active participation from the students with occasional lab practices.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

FUNDAMENTALS OF NANOMATERIALS:

Definition of nanomaterials; History of nanomaterials; Different classification schemes of nanomaterials; Nanoscience *vs*. nanotechnology; metal and metal-based nanomaterials, carbon-based nanomaterials; Nanomaterials in daily lives.

UNIT-2 **10L+10T+0P=20 Hours**

SYNTHESES AND CHARACTERIZATION OF NANOMATERIALS:

Syntheses of nanomaterials: Top-down and bottom-up approaches (minimum two examples in details from each category), green synthesis.

Important Characterization techniques: Microscopy (SEM and TEM), X-ray-based techniques (PXRD and XPS), UV and IR spectroscopy, surface area analysis.

PRACTICES:

- Students' survey on the use of nanomaterials at their homes and university.
- A well-researched review on the nanomaterial assigned to each group.
- Synthesis of metal-oxide nanomaterials using sol-gel.
- Synthesis of noble-metal nanoparticles using biological processes.
- Characterization of the as-synthesized nanoparticles using various characterization techniques available at Center of Excellence.

MODULE-2

UNIT-1 **6L+6T+0P=12 Hours**

PROPERTIES OF NANOMATERIALS:

Properties of nanomaterials: Surface area to volume ratio, basics of quantum confinement effect; Effect of shape and sizes on optical, electronic, thermal properties, and mechanical properties; Concept of nanocomposites.

UNIT-2 **10L+10T+0P=20 Hours**

NANOMATERIALS FOR EMERGING APPLICATIONS:

Nanomaterials in catalysis: Difference between homogeneous, heterogeneous and nanocatalysis; examples of surface modified nanocatalysts for organic transformations.

Nanomaterials in energy conversion and storage: Applications of nanomaterials in battery and supercapacitor, solar cell and fuel cell (at least one example of each in detail).

Nanomaterials in biology: nanomaterials in drug-delivery and imaging (at least one example of each in detail), nanotoxicity.

PRACTICES:

- Synthesis of magnetic metal oxide nanocatalysts for reduction of nitrophenol.
- Synthesis of TiO_2 or ZnO nanoparticle for the preparation of photoanode in solar cell applications.
- Synthesis of carbon-based porous nanomaterials as electrode materials in supercapacitor.
- Synthesis of CdS, CdSe QDs.
- Fabrication of TiO_2/CdS or TiO_2/CdSe photoanode using SILAR method.
- Adsorption of dye/drug onto nanomaterials.

SKILLS:

- Understand uniqueness of nanomaterials.
- Design synthetic strategies of nanomaterials.
- Apply instrumental techniques for characterization of nanomaterials.
- Asses the utility of nanomaterials in energy conversion and storage.
- Identify the importance of nanomaterials for catalytic and biological applications.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the basic science concepts to various nanomaterials and their relevance in daily lives.	Apply	1	1, 2, 6, 9, 10, 12
2	Identify specific synthetic strategies and characterization techniques of various nanomaterials.	Analyze	1	1, 2, 3, 5, 9, 10, 11, 12
3	Correlate the properties of nanomaterials with specific applications.	Analyze	2	1, 2, 5, 6, 7, 9, 10, 12
4	Evaluate suitable nanomaterials for the emerging applications.	Evaluate	2	1, 2, 3, 5, 9, 10, 11, 12

TEXT BOOKS:

1. T. Pradeep, “A Textbook of Nanoscience and Nanotechnology”, McGrawHill, 2017.
2. S. Roy, C. K. Ghosh, C. K. Sarkar, “Nanotechnology: Synthesis to Applications”, CRC Press, 2018.

REFERENCE BOOKS:

1. D. Vollath, “Nanomaterials: An Introduction to Synthesis, Properties and Applications”, Wiley-VCH, 2013.
2. B.S. Murty, P. Shankar, B. Raj, B. B. Rath, J. Murday, “Textbook of Nanoscience and Nanotechnology”, Springer, 2013.
3. C. N. R. Rao, A. Muller, A. K. Cheetham, “The Chemistry of Nanomaterials: Synthesis, Properties and Applications”, Wiley-VCH, 2004.
4. E. Gileady, “Physical Electrochemistry, Fundamental, Techniques and Applications”, Wiley-VCH, 2011.

Image source: https://www.springeropen.com/p/nano

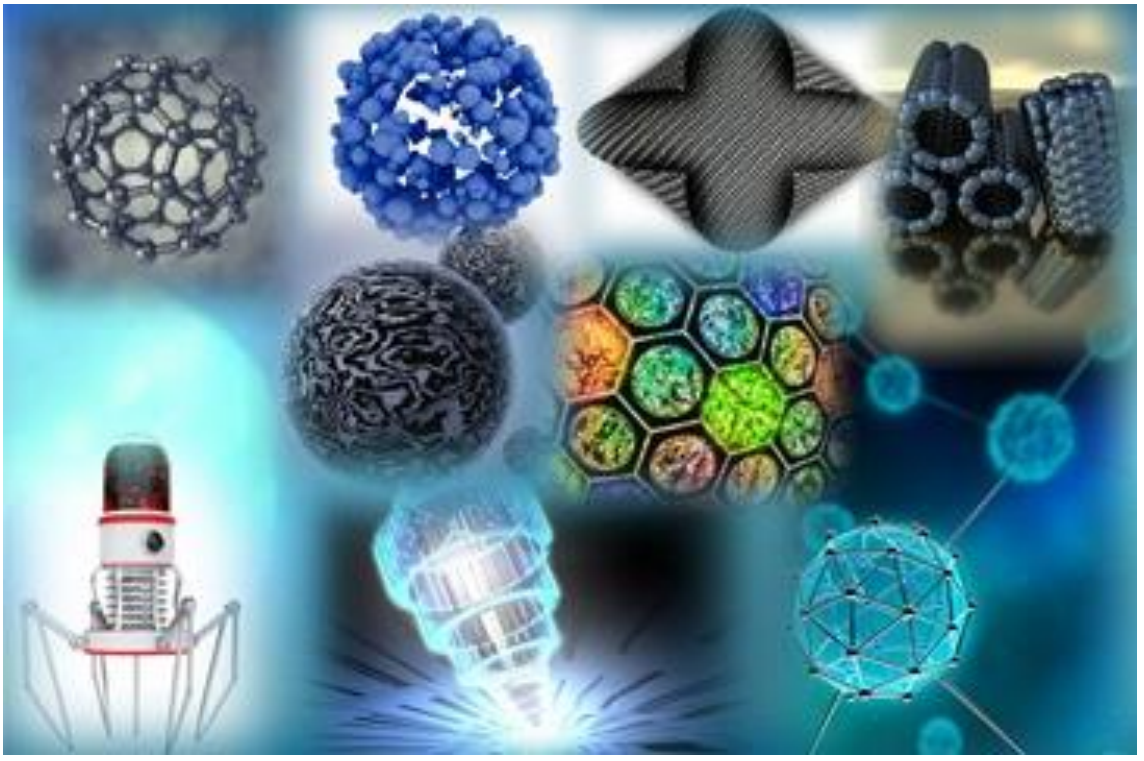

Image file name: **22CT858 – NANOSCIENCE AND TECHNOLOGY**

22CT859 – ORGANIC AND NANOMATERIALS FOR ELECTRONIC AND OPTICAL PROPERTIES

Hours per week:

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basic in chemistry or nanomaterials

COURSE DESCRIPTION AND OBJECTIVES:

This course is aimed at offering on the concepts of organic and nano materials which will help to design, synthesis and apply various electronic optical device materials such as OLEDs, OFETs, solar Cells, photovoltaics and Photonics etc. This course will make the student familiar with basic concepts of organic and nanomaterials and their applications related to Electronic and Optical Properties.

MODULE 1

UNIT-1 **8L+8T+0P=16 Hours**

INTRODUCTION TO ORGANIC MOLECULAR MATERIALS:

Introduction to Molecular Organic materials; Synthesis of Molecular Organic materials; Characterization methods; Band gap of solids; Organic semiconductors, organic Conductors and insulators.

UNIT-2 **8L+8T+0P=16 Hours**

ELECTRONIC AND OPTICAL PROPERTIES OF ORGANIC MOLECULAR MATERIALS:

Organic LEDS; Organic FETs; Organic solar cells and photovoltaics; Organic Photonics.

PRACTICES:

- Synthesis of Molecular Organic compounds.
- Characterization by Organic compounds UV-Vis.

MODULE 2

UNIT-1 **8L+8T+0P =16 Hours**

INTRODUCTION TO NANOMATERIALS:

Introduction to Nanomaterials; Synthesis of Nanomaterials - Top down and Bottom up methods; Synthesis and Characterization of Carbon-based Nanomaterials - CNTs, Graphene, Carbon dots.

UNIT-2 **8L+8T+0P=16 Hours**

ELECTRONIC AND OPTICAL PROPERTIES OF NANOMATERIALS:

Properties of Nanomaterials; Properties of CNTs, Graphene and Carbon dots; Band gap of Nanomaterials; Optical and electronic properties of CNTs, Graphene, Carbon dots, Quantum dots.

PRACTICES:

- Synthesis of Nanomaterials.
- Characterization of Nanomaterials by XRD.

SKILLS:

- Design and synthesize various Organic Molecular Materials.
- Design and synthesize various Nanomaterials.

- Characterize the synthesized Organic and Nanomaterials various characterization techniques.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the fundamental knowledge of the synthesis and characterization of organic molecular materials.	Apply	1,2	1, 2, 3, 6, 9, 10 12
2	Apply the fundamental ideas of the synthesis and characterization of nanomaterials.	Apply	1,2	1, 2, 3,4, 6, 9, 10, 12
3	Characterize and analyze organic molecular materials for optoelectronic applications.	Analyze	1, 2	1, 2, 3, 4, 6, 7, 9, 10, 12
4	Design various nanomaterials to optoelectronic applications.	Evaluate	1, 2	1, 2, 3, 4, 6, 7, 9, 10, 12

TEXT BOOKS:

1. W. D. Callister, "Materials Science and Engineering, An Introduction". Wiley-VCH, 10th Edition, 2018.
2. W. C. Sanders, "Basic Principles of Nanotechnology", CRC Press, 1st Edition, 2018.

REFERENCE BOOKS:

1. E. K. Prasad Ghatak, M. Mitra "Nanomaterials: Electronic, Properties", Vol. 1, De Gruyter, 2018.
2. O. Ostroverkhova (Ed.), "Handbook of Organic Materials for Electronic and Photonic Devices: Properties and Applications", Woodhead Publishing, 2nd Edition, 2018.

Image source: KPRao et al., JACS, 2010

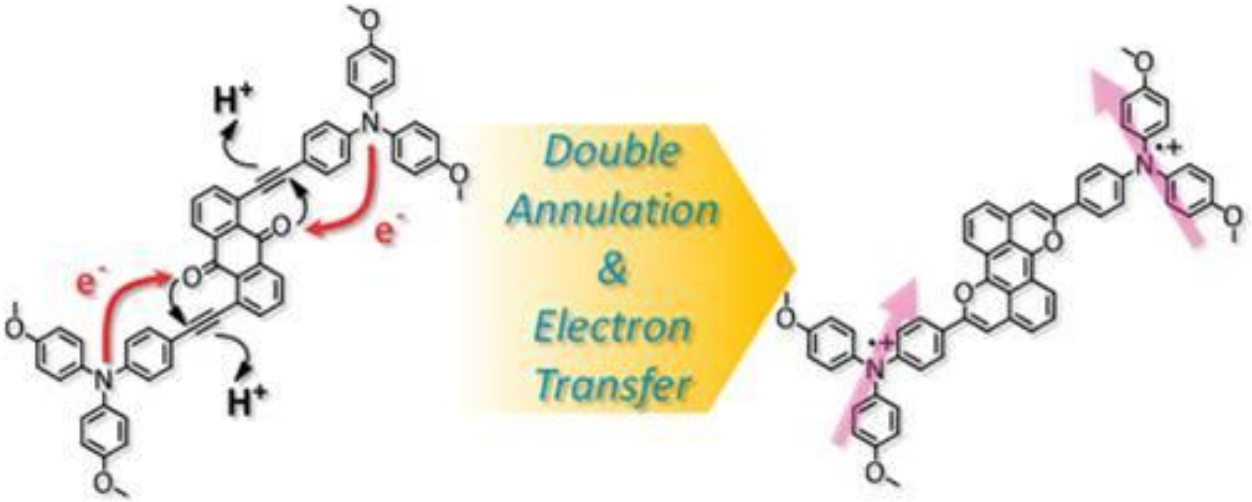

Image file name: **22CT859 – ORGANIC AND NANOMATERIALS FOR ELECTRONIC AND OPTICAL PROPERTIES - 1**

22CE851 - DISASTER MANAGEMENT

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Environmental Studies and Environmental Engineering.

COURSE DESCRIPTION AND OBJECTIVES:

This course is intended to provide fundamental understanding of different aspects of Disaster Management. It will expose the students to the concept and functions of Disaster Management and to build competencies of Disaster Management professionals and development practitioners for effective supporting environment as put by the government in legislative manner. It would also provide basic knowledge, skills pertaining to Planning, Organizing and Decision making process for Disaster Risk Reduction.

MODULE - 1

UNIT-1 **10L+ 2T +0P =12 Hours**

DISASTERS:

Introduction and Concept of disasters and hazards related to Tsunami, Volcanic eruption, Cyclones, Floods, Drought, Forest fires, Avalanches and Pest infestation.

Landslide: Introduction, causes, prevention and correction.

Earthquake: Introduction, Intensity and magnitude of earthquakes;

Floods: Causes, nature and of frequency flooding

UNIT-2 **8L+12T+ 0P =20 Hours**

MITIGATION METHODS:

Prediction and perception of hazards and adjustments to hazardous activities; Landslide hazard mitigation; Geographic distribution of earthquake zones; seismic waves, travel-time and location of epicentre; Protection from earthquake hazards; nature and extent of flood hazard; urban floods, environmental effects of flooding; flood mitigation methods.

PRACTICES:

- Prediction and mitigation of various hazards
- Mitigation of Landslide hazard
- Study of geographic distribution of seismic zones
- Precautionary measures in seismic areas
- Mitigation of floods

MODULE - 2

UNIT-1 **10L+ 2T +0P =12 Hours**

CYCLONES AND DROUGHT:

Tropical cyclone- formation and consequences. Coastal erosion; sea level changes and its impact on coastal areas. Nature of drought and effect on plant and animal systems; Study of pattern of forest fires; Disaster management: Capability- Vulnerability; Disaster management Act and Policy.

UNIT-2 **8L+12T+ 0P =20 Hours**

DISASTER MANAGEMENT:

Mitigation of forest fires; Geological and environmental investigations for the construction of dams, bridges, highways and tunnels; Risk- preparedness and mitigation- Disaster management cycle; Disaster Management case studies.

PRACTICES:

- Precautionary measures during/after cyclones.
- Mitigation of Coastal erosion.
- Mitigation of forestfires.
- Geological and environmental investigations for the construction of dams, bridges, highways and tunnels.
- Disaster Management case studies.

SKILLS:

- Able to reduce disaster Risk.
- Able to plan for prevention, mitigation the impact of hazards.
- Assess the impact of upcoming projects.
- Able to understand hazard and vulnerability profile of India.

COURSE OUTCOMES:

Upon successful completion of this course, student will have the ability to:

Cos	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Make use of the basic concepts of disaster and hazard.	Apply	1	1,2
2	Analyze preventive measures and mitigation of land slide, earthquake and floods.	Analyze	1	1,2
3	Analyze preventive measures and mitigation of cyclones, drought.	Analyze	2	1,2
4	Design to reduce risk factors of disaster.	Create	2	1,2,5,12

TEXT BOOKS:

1. K. Smith, and N.P. David, –Environmental Hazards‖ Routledge, London, 5th Edition, 2009.
2. F.G. Bell, –Geological Hazards‖ Routledge, London, 1999.

REFERENCE BOOKS:

1. E. Bryant, –Natural Hazards‖, Cambridge University Press, London, 1985.
2. D.S. Krynine, and W.R. Judd, –Principles of Engineering Geology‖CBS, New Delhi, 1998.

Source Link: https://www.rivernetwork.org/river-water-conservation-organizations-role-disaster-management/

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22CE852 - ECOLOGICAL ENGINEERING

Hours per week:

L	T	P	C
2	2	0	3

PRE-REQUISITE COURSE: Environmental Engineering

COURSE DESCRIPTION AND OBJECTIVES:

Principles of ecological engineering and design of sustainable ecosystems that integrate human society with its natural environment for the benefit of both. Particular emphasis is placed on application of ecological engineering in the restoration of streams and rivers, lakes and reservoirs, wetlands, and coastal ecosystems, as well as treatment wetlands and mined land reclamation.

MODULE - 1

UNIT-1 **10L+2T+0P= 12Hours**

ECOLOGICAL ENGINEERING DESIGN:

Ecosystem Services, Energy and Mass Flow Though Ecosystems, Estimation of NPP, Defining Biomes, Eco Regions and Watershed, Defining The Place: Site, Soils as Living Organisms

UNIT-2 **6L+14T+0P=20Hours**

DESIGNING COMMUNITY STRUCTURE:

Types of Restoration Design, Biotic Interactions, Regional Processes, Environmental and Habitat Impacts. Ecosystem Control and Feedback Systems: Population Control processes, community control processes, Feedback processes, designing ecosystem complexity.

PRACTICES:

- Concept of Ecosystem Services.
- Estimation of NPP.
- Analysis of Energy and Mass Flow Though Ecosystems.
- Types of Restoration Design
- Community control processes

MODULE - 2

UNIT-1 **10L+2T+0P= 12Hours**

TREATMENT WETLANDS:

Non-Point Source Management of wastes in Engineered Ecosystems, Fundamentals of non- point source pollution including quantification of environmental impact and ecosystem management related to contaminants and nutrients and to planning and design of ecological systems, Biodiversity and Treatment Wetlands, Wetland creation and restoration, Case studies.

UNIT-2 **6L+14T+0P=20Hours**

RESTORATION ECOLOGY:

Restoration concepts, how to Restore an Ecosystem, Procedures and Policies, Case Studies of lake and river restoration Stream Restoration Design: Hydrology, sedimentology, geomorphology, habitat, connectivity, riparian corridor.

PRACTICES:

- Non-Point Source Management of wastes
- Environmental impact and ecosystem management
- Planning and design of ecological systems
- Biodiversity and Treatment Wetlands Design.

SKILLS:

- Importance of Eco.
- Application of ecological engineering in the restoration
- Human society with its natural environment
- General performance of treatments
- Design of different types of system.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

COs	Course Outcomes	Blooms Level	Module No.	Mapping With POs
1	Distinguish the levels of ecosystems	Analyze	1, 2	2, 5,7,12
2	Analysis the importance of ecosystems	Analyze	1, 2	1, 2,7,12
3	Evaluate the factors in environment that cause disturbances in ecosystems	Evaluate	1	1, 2,7,12
4	Identifying the ecological engineering in restorations organisms.	Create	1, 2	2, 3,7,12

TEXT BOOKS:

1. Vaishali A, –Environment and Ecology‖, McGraw Hill, Michel J.G., 1st Edition, 2020.
2. Marty D. Matlock, Robert A. Morgan, –Ecological Engineering Design Restoring and conserving ecosystem services‖ 2nd Edition, Wiley, 2016

REFERENCE BOOKS:

1. Sven Erik Jorgensen, –Applications in Ecological Engineering‖, Academic Press, 2009.
2. Ecological Engineering and Ecosystem Restoration, William J. Mitch, Sven Erik Jorgensen, 2003.
3. Patrick K, –Ecological Engineering Principles and Practices‖, 1st Edition, Lewis Publishers, 2003.
4. William J. Mitch, –Ecological Engineering and Ecosystem Restoration‖, 1st Edition, Wiley, 2003.

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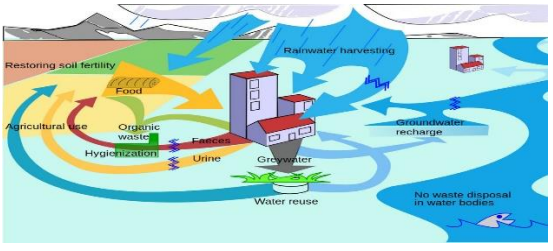


22C853- ENVIRONMENTAL POLLUTION AND CONTROL

Hours per week:

L	T	P	C
2	2	0	3

PRE-REQUISITE COURSE: Environmental Engineering.

COURSE DESCRIPTION AND OBJECTIVES:

The course has been designed to analyse about different pollution levels and control strategies and the skills of application of remediation techniques to combat pollution in four environmental compartments i.e. air, water, noise and soil. The course will also be dealing about the sources of pollution in air, soil, water, solid-waste and noise and the impacts these sources on the environment and health. In addition, the students will be given the training to develop the particular skills required in pollution related structured research.

MODULE - 1

UNIT-1 **10L+2T+0P= 12Hours**

ENVIRONMENTAL POLLUTION:

Definition and sources of pollution; Types of Pollutants and their classification. Different types of pollution and their global, regional and local aspects. Air Pollution: Types and sources of air pollutants; Effects of pollutants on human beings, plants, animals and materials. Water Pollution: Sources of pollution of surface and ground water, Water pollution parameters – physical, chemical and biological; Types of water pollutants; Effects of water pollution on water bodies - eutrophication, aquatic life, vegetation and human health; Control of water pollution.

UNIT-2 **6L+14T+0P=20Hours**

SOIL POLLUTION AND SWM:

Sources, effects and control of soil pollution. Pollution and residual toxicity from the application of insecticides, pesticides and fertilizers. Municipal solid waste Definition - Sources and types of solid waste-composition and its determinants of Solid waste-factors influencing generation-quantity assessment of solid wastes-methods of sampling and characterization. Collection transfer, control and management of Municipal Solid Waste.

PRACTICES:

- Concept of levels of pollution.
- Effects of pollution on humans.
- Analysis of pollution at different zones.
- Stress variations in steel.
- Effects of pollution on environment.
- Control measures of pollution.

MODULE - 2

UNIT-1 **10L+2T+0P= 12Hours**

NOISE POLLUTION:

Noise pollution – source, measurement, effects and control; Thermal pollution: Definition and sources, Chemical and biological effects of thermal pollution, Effect on marine life, bacteria and water quality and other aquatic biota; Thermal pollution from power plants and their control.

UNIT-2 **6L+14T+0P=20Hours**

ELECTRONIC WASTE (E-WASTE) & RADIATION POLLUTION:

Sources and types, constituents of E-wastes, recycling of e-waste and its environmental consequences, Management of e-wastes, Basel convention. Radioactive decay; Interaction of radiation with matter; Biological impact and health hazards associated with radiation, Protection against ionizing isotopes; Radioactive waste disposal.

PRACTICES:

- Effects of aquatic ecosystem due to thermal pollution.
- Sources & cause of noise.
- Effects on marine life.
- Control of thermal pollution.
- Protection of environment.

SKILLS:

- The properties and compositions of elements in pollution.
- Analysis of different pollution levels.
- General control of pollution.
- Design of pollution related structured research.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

COs	Course Outcomes	Blooms Level	Module No.	Mapping With POs
1	Identify the factors in environment that cause health and hazards.	Apply	1	1, 2,7,12
2	Estimate the quality standards on pollution.	Analyse	1, 2	2, 5,7,12
3	Analyse the technologies to access the environmental management systems.	Analyse	1, 2	1, 2,7,12
4	Find out control Measures of Pollution.	Create	1, 2	2, 3, 5,7,12

TEXT BOOKS:

1. Prakash Guptha, –Environmental Pollution Control Engineering 1st Edition, Khanna Publishing, 2019.

2. C S Rao, –Environmental Pollution Control‖, 3rd Edition, New Age International Pvt. Ltd., Publishers, 2018.

REFERENCE BOOKS:

1. Kishor R P, –Environmental Science‖ S. C. Santra, 1st Edition, Nirali Prakashan, 2018.

2. C. S. Rao, Wiley Eastern Ltd, –Environmental Pollution Control Engineering‖, New Age International Ltd, 2010.

3. P R Trivedi, –Environmental Pollution and Control‖, 2nd Edition, Ashish publishing House, APH, 2010.

Source Link: https://byjus.com/chemistry/strategies-to-control-pollution-and-reduce-waste/
Image:

22CE854 - REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM

Hours per week:

L	T	P	C
2	0	2	3

PRE-REQUISITE KNOWLEDGE: NIL

COURSE DESCRIPTION AND OBJECTIVES:

This course provides an introduction to Geographic Information Systems - a set of hardware, software, and methods for the capture, storage, management, manipulation, analysis, modelling, and display of geographic information, used to solve complex spatial planning problems. Specific GIS methods are covered for use in a variety of applications areas and disciplines, including cartography, demographics, site selection, marketing analysis, transportation studies, land use applications, spatial statistics, and environmental applications. Industry standard GIS software tools are used to apply these methods.

MODULE - 1

UNIT-1 **12L+0T+0P = 12 Hours**

Remote sensing basic definition and process, Passive and active remote sensing. Electromagnetic Spectrum, Resolution, Characteristics of Various sensors and satellites, Fundamentals of Image Processing. Map as a model, Spatial elements and terminology, Map scale, Spatial referencing system, Computers in map production, General software's in map production.

UNIT-2 **4L+0T+16P=26 Hours**

Types of data products; Image interpretation strategy, Levels of interpretation keys; Topography, Types of Drainage Pattern and Texture, Erosion; Basic elements of image interpretation. Overview on visual image interpretation equipment.

PRACTICES:

- Study of toposheet and base map preparation
- Preparation of Road network map from toposheet and satellite image
- Preparation of Drainage map from toposheet and satellite image
- Preparation of Watershed map from toposheet and satellite image
- Preparation of slope map from toposheet and satellite image

MODULE - 2

UNIT-1 **12L+0T+0P = 12 Hours**

A brief history of GIS, GIS architecture, Components of a GIS, GIS workflow, Theoretical models of GIS: Functional elements, Fundamental operations, Theoretical framework, GIS categories, Levels / scales of measurement. The data stream, Data input methods: Keyboard entry, Manual digitizing, Scanning and automatic digitizing. Stages of GIS data modeling; Raster and Vector data representation, Spatial data models; Data editing, Detecting and correcting errors, Data reduction and generalization Edge matching and Rubber sheeting, Components of data quality, Sources of error in GIS.

UNIT-2 **4L+0T+16P=26 Hours**

Land use / Land cover studies, slope mapping, preparation of structures map, Ground water prospects mapping, Watershed management and Action plan, Water quality modeling, Salt Water intrusion models, pipeline alignment studies, Solid and hazardous waste disposal site selection, Landslides mapping, Urban planning and Management, GPS applications.

PRACTICES:

- Preparation of Landuse/Land cover map from toposheet and satellite image
- Preparation of Geomorphology map from toposheet and satellite image
- Scanning and digitization of maps using Autocad,Autocad Map, Microstation and other digitizing software
- Demonstration of GIS software and its applications – ARC/INFO, Arc View, SPANS etc.
- Data editing, manipulation and analysis using ARC/INFO GIS software or open source GIS
- Map Composition and Output Generation using Arc View GIS software or open source GIS

SKILLS:

- Image Interpretation technique
- Identify the outcome from aerial photographs.
- Identify the differences between roads and water bodies from satellite images.
- Develop different Application using images.
- Develop various Information systems using GIS software

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

Cos	Course Outcomes	Blooms Level	Module No.	Mapping With POs
1	Identify the data quality of GIS and apply different applications of remote Sensing and	Apply	2	1, 2, 5, 12
2	Analyze basic concepts of remote sensing and maps.	Analyze	1	5, 6, 10
3	Examine the elements of image interpretation.	Analyze	1,2	1, 2, 12
4	Assess the basic components and data type of GIS.	Evaluate	1,2	1, 12

TEXT BOOKS:

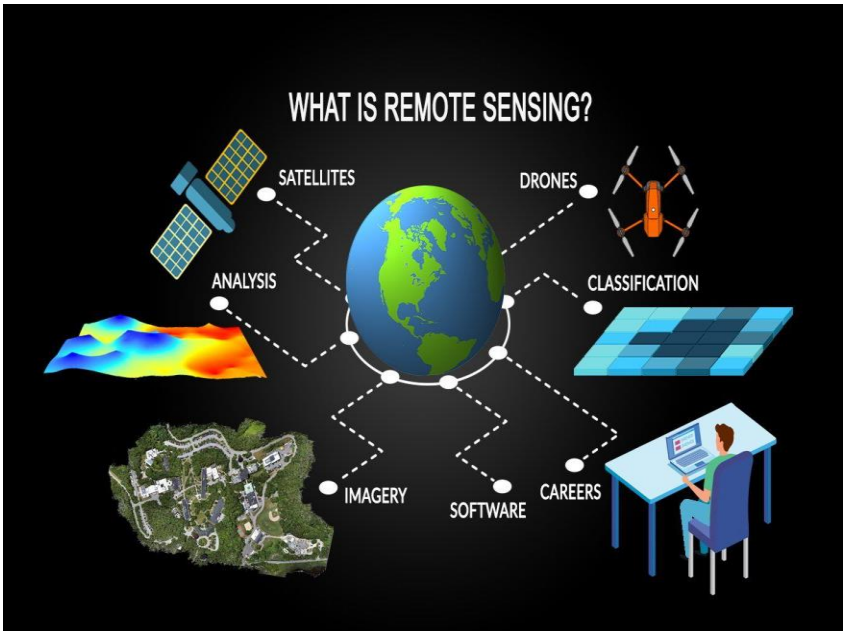
1. Remote Sensing and GIS- by B. Bhatia Published by Oxford University Press, 2019.
2. Text book of Remote sensing and GIS by M. Anji Reddy, BS Publications, Hyderabad, 3rd Edition, 2020.

REFERENCE BOOKS:

1. Geoinformatics for Environmental management‖ by M. Anji Reddy, B.S Publications, Hyderabad.
2. Remote Sensing and Image Interpretation- by Lillesand, Kiefer and Chipman, Published by John Wiley and Sons, Inc, New York, 5th Edition, 2007.

Source link: https://www.kpstructures.in/2021/05/remote-sensing-gis-and-its-applications.html

Image:



22CE855 - SANITARY ENGINEERING

Hours per week:

L	T	P	C
2	2	0	3

PRE-REQUISITE COURSE: Environmental Studies.

COURSE DESCRIPTION AND OBJECTIVES:

The course has been designed to improve the understanding about a solid technical competence for the design, installation, operation, maintenance, planning, optimization and evaluation of water treatment and supply plants and networks, as well as sewage water and industrial waste treatment and recycling processes and plants

MODULE - 1

UNIT-1 **10L+2T+0P= 12Hours**

PUBLIC HEALTH:

Definition, Health and disease. Components of Epidemiology and health, types of diseases. Determinants of health. Concept of disease: Causative agent, host factor and modes of transmission of disease. Disease Prevention and Control. Environmental Sanitation: History of sanitation. Definition, Concept and importance of Environmental Sanitation. Rural and urban sanitation. Rural sanitation in India. Urban sanitation in India.

UNIT-2 **6L+14T+0P=20Hours**

WATER SANITATION:

Sources of water. Impurities of water and water quality. Water-borne diseases (intestinal diseases). Protection of water storage in reservoirs, wells and overhead tanks. Purification of water on a small scale (household level and small communities).

PRACTICES:

- Concept of types of diseases
- Environmental sanitation awareness
- Analysis of diseases transmission.
- Purification of water analysis
- Water borne diseases levels

MODULE - 2

UNIT-1 **10L+2T+0P= 12Hours**

LOW COST SANITATION:

Existing scenario of waste disposal systems. Health and socio economic criteria for low cost sanitary Privies. Night soil and excreta disposal.

Insect vector and rodent control: Mosquitoes, rodent and house fly: habits, life cycle, diseases and their control measures.

UNIT-2 **6L+14T+0P=20Hours**

INDOOR AND INSTITUTIONAL SANITATION:

Principles of indoor sanitation. Ventilation: type of ventilation and standards for ventilation. Lighting and illumination: Requirement of good lighting, measurement of light, sources of lighting, types of illumination, standards for illumination. Air disinfection, thermal comfort and Noise

control in indoor environments. Institutional Sanitation: Sanitation in Schools. Sanitation of hospitals and nursing homes. Sanitation in restaurants and fairs. Sanitation at public bathing places and swimming pool sanitation.

PRACTICES:

- Scenario of waste disposal systems
- Effects of vectors
- Analysis of night soil and excreta disposal
- Principles of indoor sanitation.
- Analysis of disinfection.

SKILLS:

- Designed to improve the sanitation
- Evaluation of water treatment
- Planning and monitoring of supply plants
- Analysis of treatment quality
- Design of treatment systems.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

Cos	Course Outcomes	Blooms Level	Module No.	Mapping With POs
1	Inspect domestic waste water impacts.	Apply	1	1, 2,7,12
2	Assessment of diseases transmission	Analyze	1, 2	2,7,11,12
3	Design of low cost sanitation appearances	Analyze	1, 2	1, 2,7,12
4	Predict of standards for good sanitation	Create	1, 2	2, 3,7,12

TEXT BOOKS:

1. K.V.S.G. Murali Krishna and P.V. Rama Raju, 2009, Environmental Sanitation (Social and Preventive Medicine) 1st edition (2009), Environmental Protection Society, Kakinada.
2. P. Venugopala Rao, 2010, Text Book of Environmental Engineering‖ by PHI Learning Private Ltd., 7th Edition.

REFERENCE BOOKS:

1. Baljeet S. Kapoor, 2001, –Environmental Sanitation‖, S. Chand & Company Limited, 1st Edition.
2. Victor M. Ehler and Ernest W. Steel, 2000, –Municipal and Rural Sanitation‖ 9th Edition by Tata Mcgraw Hill Publishing Company.

SourceLink:https://en.wikipedia.org/wiki/Sanitary_engineering#/media/File:Steps_in_a_typical_wastewater_treatment_process.pn

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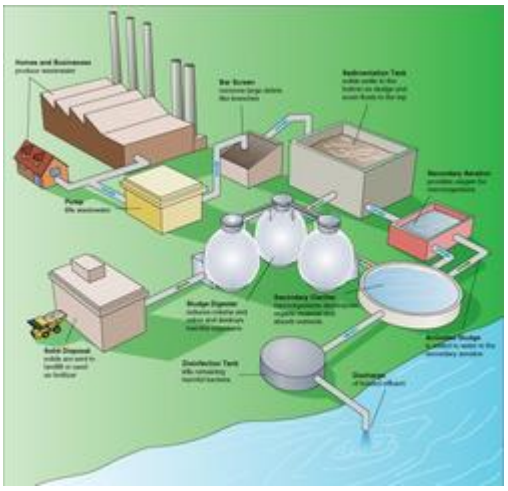


22CE856 - SOLID WASTE MANAGEMENT

Hours per week:

L	T	P	C
2	2	0	3

PRE-REQUISITE KNOWLEDGE: Nil

COURSE DESCRIPTION AND OBJECTIVES:

This course provides an understanding of Solid Waste Management and its current scenario as well as Challenges in Engineered Systems. Not only the analysis on conversion of Solid waste but also Recovery as well as Application of Landfills for Municipal Solid Waste Management.

MODULE - 1

UNIT-1 **8L+4T+0P = 12 Hours**

MUNICIPAL SOLID WASTE:

Types of solid wastes, Sources of Municipal and Hazardous wastes, Properties of solid wastes-Physical and Chemical composition.

UNIT-2 **8L+12T+0P = 20 Hours**

SOLID WASTE MANAGEMENT:

An Overview, Introduction – Reduction, Reuse and Recovery, Waste Disposal Options, Current Scenario and Challenges Engineered Systems for Solid Waste Management: Functional Elements, Solid waste generation, On-site handling, Storage and Processing, Collection of solid wastes, Transfer and Transport, Processing of Solid wastes, Ultimate disposal.

PRACTICES:

- Concept of Solid Waste Management.
- Concept of Municipal Solid Waste.
- Analysis of Properties of Solid Waste.
- Sources of Solid Waste & Municipal Solid Waste.
- Analysis of Transfer and Processing of Solid Waste.

MODULE - 2

UNIT-1 **8L+4T+0P=12Hours**

CONVERSION OF SOLID WASTE AND RECOVERY:

Mechanical processing and Material recovery systems. Biological Conversion-Composting, Anaerobic Digestion. Thermal Conversion- Combustion, Incineration, Gasification, Pyrolysis, Refuse Derived Fuel, Energy recovery systems.

UNIT-2 **8L+12T+0P = 20 Hours**

LANDFILLS FOR MUNICIPAL SOLID WASTES:

Land Filling of Municipal Solid Wastes, Site selection, Planning, Design and Operation. Landfill Gas- composition, Collection. Leachate environmental effects, Leachate collection systems, Treatment of leachate, MoEF rules, and CPCB guidelines for hazardous waste land filling.

PRACTICES:

- Anaerobic Digestion.
- Thermal Conversion of Solid Waste.
- Biological Conversion of Solid Waste.
- Factors considering for Site Selection of Landfill.
- MoeF rules and CPCB guidelines

SKILLS:

- Analysis on types of Solid wastes.
- Analyse the Challenges involved in SWM.
- Analyse MSW and recommend Landfills.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

Cos	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Identify the sources, types and Properties of solid wastes.	Apply	1	1, 2
2	Analyze the Current Scenario and Challenges Engineered Systems for Solid Waste Management:.	Analyze	1	1, 2
3	Analyze the Conversion of Solid wastes and Recovery.	Analyze	2	1, 2
4	Assess the Land Filling of Municipal Solid Wastes and MoEF rules, CPCB guidelines for hazardous waste land filling.	Evaluate	2	1, 2, 5, 12

TEXT BOOKS:

1. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous (1985), Environmental.
2. Engineering, Mc Graw-Hill International Editions, NewYork.

REFERENCE BOOKS:

1. Solid waste Engineering by P. Aarne Vesilind, Willium Worrell and Debra Reinhart, (2004), Cengage Learning India Private Limited, New Delhi.
2. Venkatappa Rao. G and Sasidhar. R.S. (2009), Solid waste management and Engineered Landfills, Sai Master Geoenvironmental Services Pvt.Ltd, Hyderabad.

Source Link: https://evreka.co/blog/smart-solutions-in-municipal-solid-waste-management/

Image:

22CS851 - DATABASE SYSTEMS

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Discrete Mathematical Structures

COURSE DESCRIPTION AND OBJECTIVES:

This course presents an introduction to database management systems with an emphasis on how to organize, maintain and retrieve data efficiently from a relational database. It also focuses on requirements gathering and conceptual, logical, physical database design. The objective of the course is to enable the student to understand database design, expressing queries using SQL, query optimization and transaction processing.

MODULE-1

UNIT-1 **8L+0T+4P=12 Hours**

DATABASE SYSTEM CONCEPTS:

Databases and Database Users: Introduction; Characteristics of the database approach; Actors on the scene; Advantages of using DBMS approach.

Database System Concepts and Architecture: Data models, Schemas and instances; Three-Schema architecture and data Independence; Database languages and interfaces; The database system environment; Centralized and Client-Server architectures for DBMS.

Conceptual Data Modeling and Database Design: Entity types, Entity sets, Attributes and keys; Relationship types, Relationship sets, Roles and structural constraints; Weak entity types; Relationship types.

UNIT-2 **8L+0T+12P=20 Hours**

RELATIONA DATABASE DESIGN:

Relational Database Design by Er-To-Relational Mapping: Relational Database design using ER-to-Relational mapping.

The Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and Relational database schemas.

SQL: SQL data definition and data types; specifying constraints in SQL, Basic retrieval queries in SQL; INSERT, DELETE, and UPDATE statements in SQL.

PRACTICES:

- Design ER Model for various real time database applications.
- Development of Relational Database schemas for Company/Student/Sailors/ using DDL constructs of SQL.
- Apply various DML Commands such as select, insert, update etc. of SQL on Relational Database.
- Design of Relational Database schemas by specifying different types of Constraints.
- Apply various Relational Database operators (Arithmetic, Logical &comparison) and string-matching constructs of SQL.
- Expressing queries using Aggregate Functions of SQL on Relational Database.
- Queries on Relational Database using GROUP BY, HAVING and ORDER BY clauses of SQL.

MODULE-2

UNIT–1 **8L+0T+12P=20 Hours**

NORMALIZATION

Complex Queries, Views: More complex SQL retrieval queries; Views (virtual tables) in SQL.

Basics Of Functional Dependencies and Normalization For Relational Databases: Informal design guidelines for relation schemas; Functional dependencies-inference rules, equivalence and minimal cover; Normal forms based on primary keys; Boyce-Codd normal form; Properties of relational decompositions, multivalued dependency, join dependencies.

UNIT–2 **8L+0T+4P=12 Hours**

TRANSACTION PROCESSING

Introduction To Transaction Processing Concepts and Theory: Introduction to transaction processing; Transaction and system concepts; Desirable properties of transactions; Characterizing schedules based on serializability.

Concurrency Control Techniques: Two-phase locking techniques for concurrency control, concurrency control based on timestamp ordering.

Database Recovery Techniques: Recovery concepts; Shadow paging; The ARIES recovery algorithm.

PRACTICES:

- Design and Development of company database and expressing Nested queries using SQL.
- Design and Development of student database and specifying queries using set operations.
- Design and Development of sailor's database and specifying queries using different types of JOINs.
- Creation and dropping of VIEWS.
- Relation R has eight attributes ABCDEFGH. Fields of R contain only atomic values. F = {CH -> G, A -> BC, B -> CFH, E -> A, F -> EG} is a set of functional dependencies (FDs) so that F+ is exactly the set of FDs that hold for R. How many candidate keys does the relation R have?
- Apply various DCL and TCL constructs of SQL on Relational Database.

SKILLS:

- Develop E-R model for real life applications.
- Design of relational databases for real world applications.
- Devise queries using relational algebra and SQL.
- Analyze transaction processing, concurrency control and recovery techniques.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Develop an E-R model for real life applications.	Apply	1	1,10
2	Express queries using database tools like Oracle, DB2, MYSQL.	Apply	2	5,10
3	Devise queries using Relational Algebra and SQL.	Analyze	2	2

4	Design and normalize databases for real time applications.	Create	1	1,3

TEXT BOOKS:

1. Ramez, Elmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”,7th edition, Pearson Education, 2016.
2. Raghu Rama Krishnan and Johannes Gehrke, “Database Management Systems”,3rd edition, TataMcGraw Hill,2013.

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, “Database System Concepts”,7th edition, Tata Mc Graw Hill,2019.
2. Allen G. Taylor “Database Development for Dummies", 1st Edition, 2011
3. C. J. Date “introduction to database systems”, 7th edition, Addison Wesley, 2003.

Database Management System

https://michellehoog.netlify.app/post/database-management/

22CS852 - MOBILE APPLICATION DESIGN AND DEVELOPMENT

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: OOPs through Java, DDL & DML Commands - DBMS

COURSE DESCRIPTION AND OBJECTIVES:

This course guides the student in designing and building a mobile application using Android™. The main objective of this course is to let the student learn basic Android programming concepts while building a variety of apps, starting with basic to making use of advanced concepts.

MODULE-1

UNIT-1 **8L+0T+8P=16 Hours**

INTRODUCTION:

Mobile Applications and Device Platforms**,** Introduction to Android and its versions; Android Architecture.

Application Development Process- Developers Workflow basics; Installing the Android SDK Tools; API Levels; Anatomy of an Android Application.

Basic Building blocks - Activities, Services, Broadcast Receivers & Content providers; Intents; Fragments.

ViewGroup- Layout: Linear Layout, Relative Layout, Grid Layout, Constraint Layout.

UNIT-2 **8L+0T+8P=16 Hours**

VIEWS:

Basic Views**;** Picker Views**; List Views –** ListView, SpinnerView.

Activities: Creating an activity, Understanding the activity life cycle using Log and Toast, applying styles and themes to an activity.

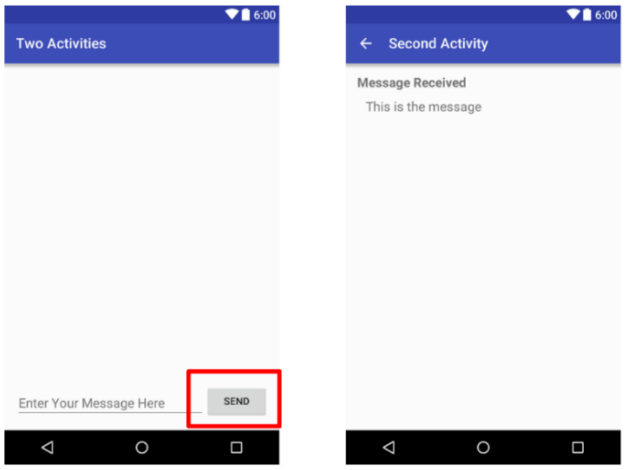
Linking Activities using Intents: Introduction to Intents and its types with examples, passing data between activities with intents.

Fragments: Introduction to Fragment, the life cycle of a fragment, Adding fragments dynamically, Interaction between fragments.

PRACTICES:

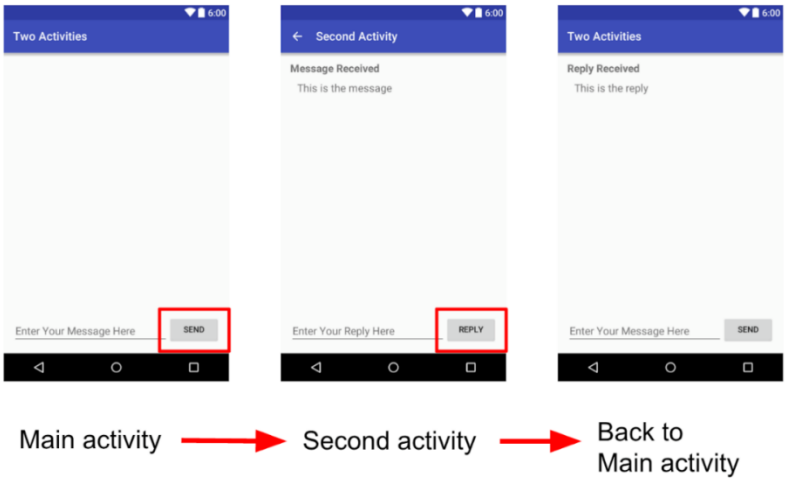
1. Setting up Android Studio:
   a. Installing Android Studio
   b. Select an empty activity to simulate the “Welcome App” Using Android Studio.
   c. Exploring the interface of the Android Studio to understand the Project Structure.
2. Develop an Android application using controls like Button, TextView, and EditText for designing a calculator having basic functionality like Addition, Subtraction, Multiplication, and Division.
3. In this assignment, students will create and build an app called Two Activities. Students will build the app in four stages.
   a. In the first stage, you create an app whose main activity contains one button, Send. When the user clicks this button, your main activity uses an intent to start the second activity.

b. In the second stage, you add an EditText view to the main activity. The user enters a message and clicks Send. The main activity uses an intent to start the second activity and sends the user's message to the second activity. The second activity displays the message received.

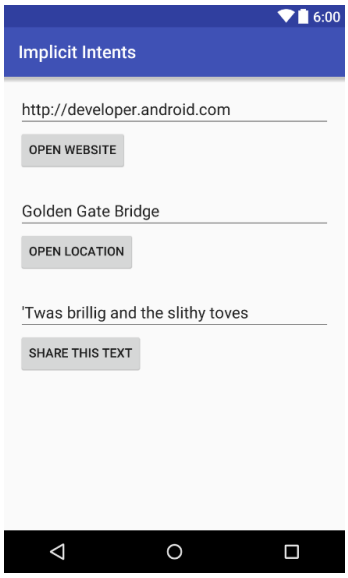


c. In the final stage of creating the Two Activities app, you add an EditText and a Reply button to the second activity. The user can now type a reply message and tap Reply, and the reply is displayed on the main activity. At this point, you use an intent to pass the reply from the second activity to the main activity.

d. Implement all the Activity lifecycle callback methods to print messages to logcat when those methods are invoked. These log messages will allow you to see when the Activity lifecycle changes state, and how those lifecycle state changes affect your app as it runs.



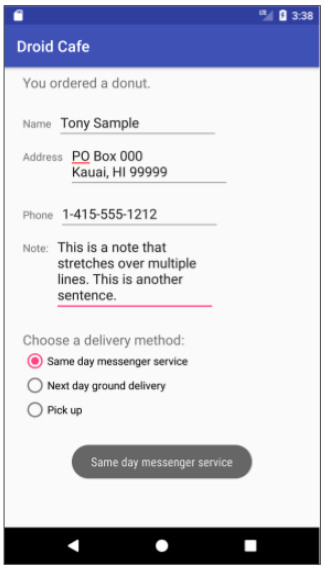
4. Design an application with **implicit intents**: Create a new app with one Activity and three options for actions: open a website, open a location on a map, and share a snippet of text. All the text fields are editable (EditText) but contain default values.



5. Design **Droid Café**: In this practical, the student will create and build a new app starting with the Basic Activity template that imitates a dessert-ordering app. The user can tap an image to perform an action—in this case, display a Toast message—as shown in the figure below. The user can also tap a shopping cart button to proceed to the next Activity.

a. Experiment with the android: inputType attribute for EditText elements. You add EditText elements for a person's name and address and use attributes to define single-line and multiple-line elements that make suggestions as you enter text. You also add an EditText that shows a numeric keypad for entering a phone number.

b. Other types of input controls include interactive elements that provide user choices. You add radio buttons to Droid Cafe for choosing only one delivery option from several options. You also offer a spinner input control for selecting the label (Home, Work, Other, Custom) for the phone number.



MODULE–2

UNIT–1 **8L+0T+8P=16 Hours**

CREATING A FEATURE-RICH APPLICATION:

Display Orientation – Anchor Views, resizing and repositioning Views, Managing changes to Screen Orientation; Notifications; Action bar; Dialog box.

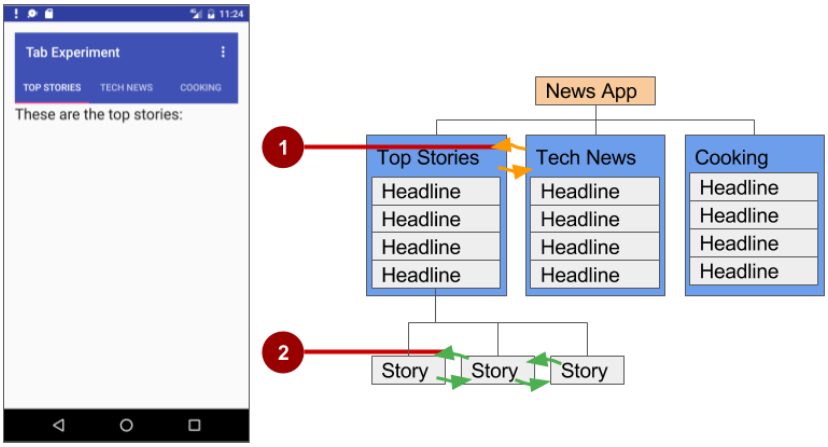
UNIT-2 **8L+0T+8P=16 Hours**

FIREBASE:

Getting Started with Firebase, Add Firebase to your Android project, Firebase database – Introduction to Firebase database, set up Firebase Real-time Database for Android, Read and Write Data on Android.

PRACTICES:

- Design an application to keep data when the user rotates the device, and when the screen is rotated: When the user rotates the device, Android will normally destroy and re-create the current Activity. You want to keep some data across this cycle, but all the fields in your Activity are lost during it.
- Design a News App- Consider the following screen as reference:

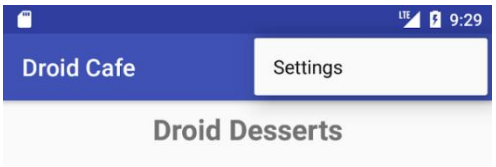


NOTE: Use Recycle View to display the news under each category.

- Adding more features to Droid Café: In the previous assignments, you created an app called Droid Café, using the Basic Activity template. This template also provides a skeletal options menu in the app bar at the top of the screen.

a. Update that menu option as shown in the following images:

b. Add notification option: The app must notify the user when the user places the order.



- Save all the user preferences in the Firebase Realtime Database to fetch whenever required.

SKILLS:

- Design mobile applications for user requirements.
- Use of suitable advanced components to design mobile apps.
- Utilization of activities, intents, layouts, and views for content

COURSE OUTCOMES:

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level	Module No	POs
1	**Apply** views, intents, and fragments to an existing application.	Apply	1	2
2	**Analyse** methods for storing, sharing, and retrieving data in an Android app.	Analyse	2	5
3	**Evaluate** an existing app to enrich it with new features.	Evaluate	2	2,3

4	**Design** and publish a mobile app in the play store with a database forgiven real-time scenarios using modern tools- Android Studio, and Firebase.	Create	2	5,10

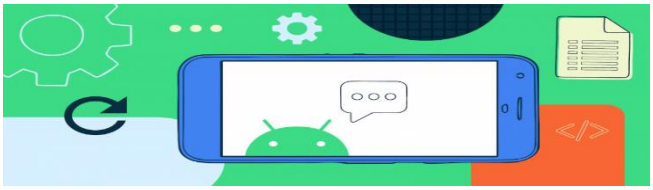
TEXT BOOKS:

1. John Horton "Android Programming for Beginners: Build in-depth, full-featured Android apps starting from zero programming experience", 3rd Edition, 2021.
2. Wei-Meng Lee, "Beginning Android Application Development", 1st edition, John Wiley & Sons, 2012

REFERENCE BOOKS:

1. https://aws.amazon.com/mobile/mobile-application-development/
2. https://google-developer-training.github.io/android-developer-fundamentals-course-concepts/
3. Michael Burton," Android App Development for Dummies ", 3rd Edition, A Wiley Brand, 2020.
4. Dawn Griffiths & David Griffiths, "Headfirst Android Development A Brain-Friendly Guide" 2nd Edition, O'Reilly, 2015.

Link for Image:
Learn Android Programming Step By Step - Codersera Blog



22CS853 - JAVA PROGRAMMING

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Classes, Objects and Inheritance.

COURSE DESCRIPTION AND OBJECTIVES:

This course is about the fundamentals of Object-Oriented Programming (OOP) Concept and OOP-based software development methodology. Java as a class-based and pure OOP language is used to demonstrate and implement appropriate concepts and techniques. The students are exposed to the concepts, fundamental syntax, and the thought processes behind object- oriented programming. By end of the course, students will acquire the basic knowledge and skills necessary to implement object-oriented programming techniques in software development using Java.

MODULE-1

UNIT-1 **8L+0T+8P=16 Hours**

INTRODUCTION:

History of Java, Byte code, JVM, Java buzzwords, OOP principles, Data types, Variables, Scope of variables, Operators, Control statements, Type conversion and casting, Arrays.

Concepts Of Classes and Objects: Introduction to methods, Method overloading, Constructors, Constructor overloading, Usage of *static* with data and method, Access control, *this* key word, Garbage collection, String class, String Tokenizer.

UNIT-2 **8L+0T+8P=16 Hours**

INHERITANCE AND PACKAGES:

Inheritance: Types of inheritance, Member access rules, Usage of *super* keyword, Method *overriding*, Usage of *final*, Abstract classes, Interfaces - differences between abstract classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

Packages: Defining, creating and accessing a package, importing packages, access control in packages

PRACTICES:

- There is a telecommunication company called "Powered Air" who have approached you to build their Interactive Voice Response (IVR) system. write a Java program and be able to provide the following menu (given below):

  Note: User should provide an input for each menu display. Welcome to Powered Air service. What would you like to do?

  a. Know my balance.
  b. Know my validity date
  c. Know number of free calls available.
  d. More

  - Prepaid Bill Request
  - GPRS activation
  - Special GPRS Offers
  - Go back to Previous menu
  - Customer Preferences
  - Special Message Offers
  - 3G Activation

You are free to display your own messages in this IVR

- Create a class *Rectangle*. The class has attributes length and width. It should have methods that calculate the perimeter and area of the rectangle. It should have read Attributes method to read length and width from user.
- Hint: Area of rectangle = length * width, Perimeter of rectangle = 2*(length+width).
- Implement a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (use StringTokenizer class)
- Implement a java program to print all tokens of a string on the bases of multiple separators (use StringTokenizer class)
- Using inheritance, one class can acquire the properties of others. Consider a class *Animal* that has only one method "walk". Next, create a *Bird* class that also has a fly method. Finally, create a bird object that can both fly and walk.
- When a subclass inherits from a superclass, it also inherits its methods; however, it can also override the superclass methods (as well as declare and implement new ones). Consider the *Sports* class having methods *getName*()[which returns name of sport] and *getNumberOfTeamMembers*()[which returns noof team members] create a *Soccer* class that inherits from the *Sports* class. We can override the getName method and return a different subclass-specific string and override *getNumberOfTeamMembers method and* return noof team members
- Implement a java program to create an abstract class named *Shape* that contains an empty method named *numberOfSides* ( ). Provide three classes named *Trapezoid*, *Triangle* and *Hexagon* such that each one of the classes extends the class *Shape*. Each one of the classes contains only the method *numberOfSides* ( ) that shows the number of sides in the given geometrical figures.
- Implement a Java program for the following
- Creation of simple package.
- Accessing a package.

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

EXCEPTION HANDLING AND MULTI THREADING:

Exception Handling: Concepts of exception handling, Types of exceptions, Usage of try, catch, throw, throws and finally keywords, Built-in exceptions, User defined exception.

Multi-threading: Concepts of multithreading, Differences between process and thread, Thread life cycle, Creating multiple threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter thread communication.

UNIT-2 **8L+0T+8P=16 Hours**

SWINGS:

GUI Programming with Swing: Delegation event model - Events, Event sources, Event Listeners, Event classes, handling mouse and keyboard events.

Exploring Swing Controls: JLabel and Image Icon, JText Field, JButton, JCheckBox, JRadioButton, JTabbed Pane, JList, JCombo Box.

PRACTICES:

- Implement a Java program to read two numbers a,b from user and perform division a/b,if the user passes b value as zero, handle the exception using try and catch otherwise display the result.
- Create a class called *Customer* with data members account_number, balance (initialize with 10000), and member functions *print(), deposit(),* and *withdraw()*. Print method display account number and balance. If withdraw amount is less than current balance while withdrawing, throw an exception "In Sufficient Funds". If the input is 1 do print. If the input is 2 withdraw (). If the input is 3 deposit. If the input is 4 terminate program.
- Implement a Java program which accepts age as input from the user and throws an exception

"Not Eligible to Vote" when age is <=18 otherwise print "Eligible to Vote".

- **Print in Order**

  Suppose we have a class:

  public class Foo {
  public void first() { print("first"); }
  public void second() { print("second"); }
  public void third() { print("third"); }
  }

  The same instance of Foo will be passed to three different threads. Thread A will call first(), thread B will call second(), and thread C will call third(). Design a mechanism and modify the program to ensure that second() is executed after first(), and third() is executed after second().

  Note:

  We do not know how the threads will be scheduled in the operating system, even though the numbers in the input seem to imply the ordering. The input format you see is mainly to ensure our tests' comprehensiveness.

  Example 1:

  Input: nums = [1,2,3]

  Output: "firstsecondthird"

  Explanation: There are three threads being fired asynchronously. The input [1,2,3] means thread A calls first(), thread B calls second(), and thread C calls third(). "firstsecondthird" is the correct output.

  Example 2:

  Input: nums = [1,3,2]

  Output: "firstsecondthird"

  Explanation: The input [1,3,2] means thread A calls first(), thread B calls third(), and thread C calls second(). "firstsecondthird" is the correct output.

- Implement a Java program for handling mouse events when the mouse entered, exited, clicked, pressed, released, dragged and moved in the client area.
- Implement a Java program for handling key events when the key board is pressed, released, typed.
- Implement a Java swing program that reads two numbers from two separate text fields and display sum of two numbers in third text field when button "add" is pressed.
- Implement a Java program to design student registration form using Swing Controls. The form which having the following fields and button "save"

  Form Fields are: Name, RNO, Mail id, Gender, Branch, Address.

SKILLS:

- To analyse and develop algorithm for real life problems using Java**.**
- Experience with developing and debugging programs in different IDEs.
- Develop multi-threaded applications.
- Creating web applications.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply object oriented concepts on real time scenarios.	Apply	1	1,2
2	Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.	Apply	1	1,2
3	Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes	Apply	2	2,3
4	Design and develop GUI based applications using swings for internet and system based applications.	Create	2	3,5

TEXT BOOKS:

1. Herbert Schildt, "Java the complete reference", 12th edition, McGraw Hill, Education, 2021.
2. M.T. Somashekara, D.S. Guru, K.S. Manjunatha, "Object-Oriented Programming with Java", 1st edition, PHI Learning, 2017.

REFERENCE BOOKS:

1. E. Balagurusamy," Programming with Java",6th edition, McGraw Hill, 2019
2. Mark Lassoff," Java Programming for Beginners: Learn the fundamentals of programming with Java", 1st edition, Packt Publishing Limited,2017.
3. Philip Conrod,Lou Tylee," Learn Java GUI Applications : A JFC Swing Tutorial", 11th edition ,Kidware Software,2019.

https://www.datasciencecentral.com/wp-content/uploads/2021/10/8667507462.jpeg

22CS854-PYTHON PROGRAMMING

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Prior knowledge of any programming language and object-oriented concepts is helpful but not mandatory.

COURSE DESCRIPTION AND OBJECTIVES:

This course offers sufficient knowledge required to understand the fundamental concepts of Python programming language. This course enables students to choose appropriate data structures (lists, dictionaries, tuples, sets, strings) for the given problem. In addition, the students will be able to create reliable, modular and reusable applications using Object- Oriented Programming approaches. At the end they will get an idea of how to access database using python programming, develop web applications, and using web Services using python
Programming.

MODULE-1

UNIT-1 **6L+0T+6P=12 Hours**

INTRODUCTION:

Introduction to python, Variables, Assignment, Keywords, Built-in functions, Indentation, Comments, Basic data types - integers, float, complex, Boolean, strings; Python program development, running python using REPL shell, Python scripts.

Operators and Expressions: Operators- arithmetic operators, comparison (relational) operators, assignment operators, logical operators, bitwise operators, membership operators, identity operators; Expressions and order of evaluations.

Control Structures: Conditional control structures - if, elif, else; Loop control structures - for, while, for... else, while…else, nested loops, break, continue, pass.

UNIT-2 **10L+0T+10P=20 Hours**

PYTHON DATA STRUCTURES AND FUNCTIONS:

Data Structures: Lists, Tuples, Sets, Strings, Dictionary - creation, accessing, basic operators and methods; List comprehensions.

Functions: Defining functions, calling functions, Passing arguments - keyword arguments, default arguments, positional arguments, variable-length arguments; Types of functions- anonymous functions, fruitful function, recursive functions; Scope of the variables- global and local variables, Development of recursive and non-recursive functions.

PRACTICES:

- A. Given an integer N, write a program to find its 1’s complement.

B. Given two integers N1 and N2, write a program to find their product without using multiplication ('*') operator and loops.

C. Given two integers N1 and N2 having same value, write a program to check whether N1 and N2 points to the same object or not.

- A. Given an Integer N, write a program to check whether given number is even or odd without using modulus operator.
  B. Given a number N, number of bits K and starting position P, write a program to extract K bits from a position P (from right) in the binary representation of N. Convert the extracted bits in decimal number.
- Given coordinates of centre of a circle, radius and a point coordinate, write a program to check whether the given point lies inside or on the circle, or outside the circle.
- Write a program to find the sum of digits in a given integer.
- Given an integer N as an input, decides the geometrical figure for which the area has to be calculated, for example N=1 for circle, N=2 for rectangle, and N=3 for triangle. Write a program to display the area of the respective figure.
- A semi prime number is an integer which can be expressed as a product of two distinct primes. For example, 15 = 3*5 is a semi prime number but 9 = 3*3 is not.
  For a Given an integer number **N**, write a program to find whether it can be expressed as a sum of two semi-primes or not (not necessarily distinct).
- Given an integer amount X, write a program to find the minimum number of currency notes $ (500, 100, 50, 20, 10, 5, 2, 1) required for the given amount.
  Input:
  575
  Where input is the amount for which we have to calculate the number of currency notes.
  Output: 4
  Explanation: Total amount = 1(500 dollar note) + 1(50 dollar note) + 1(20 dollar note) + 1(5 dollar note) = 575, hence the minimum number of notes required is 4.

- For a given a string S and width W, write a program to wrap the string S into a paragraph of width W.
  Example:
  Input:
  ABCDEFGHIJKLIMNOQRSTUVWXYZ
  4
  Output:
  ABCD EFGH IJKL IMNO QRST UVWX YZ
- Write a program to Measure the required time to access the first element, nth element and n/2 element stored in list and tuple data structure.
- Given a list L of **N** numbers (integers), Write a program to find the sum of the elements of given list **L** with the corresponding elements of the reverse of list L. If list L has elements **[1,2,3]**, then reverse of the list L will be **[3,2,1]** and the resultant list should be **[4,4,4]**.
- Given a positive integer number **n**. Write a program to generates a dictionary **d** which contains **(i, i*i*i)** such that **i** is the key and **i*i*i** is its value, where **i** is from **1 to n (both included)**. Print the content of the dictionary **d**.
- Write a program to create a data structure to store student information such as regd no, name, percentage of marks, phone number and display the student details based on the order of percentage of marks.

- For a Given a string, design and implement functions to perform the following:
  a) remove vowels in the given string.
  b) count number of uppercase and lowercase letters.
  c) remove all special characters.
  d) check whether it is a palindrome or not.
  e) swap case of each letter.
- Create a function that receives 3 numbers and returns the median, i.e. the number that is not the min and not the max, but the one in between.
- Given two lists of integer numbers, write a function to perform the following operations.
  a. print elements that are common in both the lists. (Print without duplicates).
  b. print elements that are present in the first list and not present in second list.
  c. print elements that contain the first element of the first list and last element of the second list.
  d. print elements that contain sum of elements of first list and sum of elements of second list.
  e. print largest number of both the lists.
  f. print smallest number of both the lists.

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

MODULES:

Creating modules, Import Statement, From...Import Statement, Name Spacing, Creating user defined modules

Standard Modules: sys, math, date, time, os, random and itertools modules.

Packages: Numpy, Pandas, Matplotlib, Requests, Nltk.

File Processing: Reading and writing files -creating a new file, writing to a file, reading text files, opening and closing files, reading, writing, tell (), seek (), rename ().

UNIT-2 **8L+0T+8P=16 Hours**

ERRORS AND EXCEPTIONS:

Introduction to Exceptions, Handling Exception, Try Except Else and Finally Block, Raising Exceptions.

Simple Graphics and Image Processing: Overview of Turtle Graphics, Two Dimensional Shapes, Colours and RBG System and Image Processing

PRACTICES:

- Given a string ‘S’, find all possible permutations of the string S in lexicographic sorted order. Each Permutation size is “2” or “3”.
  Sample Input:
  HACK
  Expected Output: AC AH AK CA CH CK HA HC HK KA KC KH

- Write a program that finds area of the pentagon when length from center of a pentagon to vertex are given, the formula for computing the area of pentagon is $\frac{\sqrt[3]{3}}{2} s^2$, where s is the length of the

side, the side can be computed using formula s= 2r $\sin\frac{\pi}{5}$, where r is the length from the center of a pentagon to vertex.

- Given X as a date. Write a program to find what the day is on that date.
  Sample Input: 08 05 2015
  Expected Output: Wednesday

- Arun is working in an office which is **N** blocks away from his house. He wants to minimize the time it takes him to go from his house to the office. He can either take the office cab or he can walk to the office. Arun's velocity is **V1 m/s** when he is walking. The cab moves with velocity **V2 m/s** but whenever he calls for the cab, it always starts from the office, covers **N** blocks, collects Arun and goes back to the office. The cab crosses a total distance of **N** meters when going from office to Arun's house and vice versa, whereas Arun covers a distance of (2–√∗N)(2∗N) while walking. Help Arun to find whether he should walk or take a cab to minimize the time.
  Input Format:
  A single line containing three integer numbers N, V1, and V2 separated by a space. Example-1:
  Input:
  5 10 15
  Output:
  Cab

- Create a binary NumPy array (containing only 0s and 1s) and convert a binary NumPy array in to to a Boolean NumPy array

- Convert the first column of a Data Frame as a Series by using suitable packages.
  Sample Input:
  Original Data Frame

	col1	col2	col3
0	1	4	7
1	2	5	5
2	3	6	8
3	4	9	12
4	7	5	1
5	11	0	11

Sample Output:

0	1
1	2
2	3
3	4
4	7
5	11

- Create two text files and read data from two text files. Display a line from first file followed by the corresponding line from the second file.

- Define the following functions that are more robust to erroneous input data
  a) To divide two numbers (To handle Zero Division Error).
  b) To read two integer numbers and display them (To handle Value Error).
  c) To display elements of a list (To handle Index Error).
  d) To open a file and display file contents (To handle File Not Found Error)

- Write a python program to handle multiple exceptions using raise keyword.
- Draw the spiral hexagon, where we use turtle to create a spiral structure. The final shape is a hexagon and there are various colors used in producing the sides of the hexagon.
- Implement a program to print it in a counterclockwise spiral form for a given square matrix.
  Sample Input:
  4
  25 1 29 7
  24 20 4 32
  16 38 29 1
  48 25 21 19
  Sample Output:
  25 24 16 48 25 21 19 1 32 7 29 1 20 38 29 4

- Write a function that finds the nearest prime number of a given number.

SKILLS:

- Installation and usage of python libraries.
- Working with varieties of data structures.
- Improved analytical and problem-solving abilities.
- Developing structured modular and Object-oriented programming solutions.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Make use of different data types to design programs involving decisions, loops, and functions.	Apply	1	1, 2, 5
2	Develop functional, reliable and User-friendly Python programs for given problem statement and constraints.	Apply	2	1, 2, 3,5
3	Installing the python environment and related packages that are required for practical and contemporary applications.	Apply	2	1, 2,3,5
4	Analyze various features of programming language and their application in problem solving in computer	Analyze	1	1, 2

	programming to write, compile, and debug programs in python language.			
5	Analyze the usage of different data structures for practical and contemporary applications for a given problem.	Analyze	1	1, 2, 3, 5

TEXT BOOKS:

1. Kenneth A. Lambert, "The Fundamentals of Python: First Programs", Cengage Learning, 2011.
2. Mark Lutz, "Learning Python", 5th edition, Orielly Publishers, 2013.

REFERENCE BOOKS:

1. Introduction to Computation and Programming Using Python. John V. Guttag, The MIT Press.
2. James Payne, "Beginning Python using Python 2.6 and Python 3", Wrox publishing.
3. Paul Gries, "Practical Programming: An Introduction to Computer Science using Python 3", The Pragmatic Bookshelf, 2nd edition, 4 Oct. 2013.
4. Allen B. Downey, "Think Python", 1st edition, Orielly publishing.

https://www.hitalent.co/blog/2019/12/tech-jobs-python-programming-language-and-aws-skills-demand-has-exploded

22CS855 - DESIGN AND DEVELOPMENT OF INTERNET APPLICATIONS

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: OOPs through JAVA.

COURSE DESCRIPTION AND OBJECTIVES:

This course offers the concepts of web development like static and dynamic web page design and provides internet programming knowledge, web servers, application servers, and design methodologies using object-oriented concepts. The objective of this course is to build web applications using JSP, PHP, AngularJS, and NodeJS with a client and server-side scripting technologies that span multiple domains.

MODULE-1

UNIT-1 **8L+0T+8P=16Hours**

INTRODUCTION:

HTML: Creating structured documents, Links and navigation, Tables, Forms, and Frames.

CSS: Cascading Style Sheets, CSS Properties.

Java Script: Learning Java Script- how to add scripts to your page, DOM, variables, operators, functions, conditional statements, Looping, Events, Built-in objects, form and regular expression validation.

UNIT-2 **8L+0T+8P=16Hours**

JDBC AND JSP:

JDBC: What is JDBC, system requirements, types of JDBC Drivers, creating database tables, connecting to a database, executing SQL statements, processing result sets, and making changes to a result set.

JSP: JSP Processing, Generating Dynamic Content using Scripting Elements, Implicit JSP Objects, Sharing Data between JSP pages,JSP application design with JDBC.

PRACTICES:

- Design a webpage having four frames named a)Top, b)Center, c)Bottom, and d) Left. The top frame should contain the company logo and title. The bottom frame should contain copyright information. The left frame should contain various links like Home, Products, Services, Branches, About, etc., When clicked on respective links, the content should display on the center frame.
- Design a catalog page that should contain the details of all the books available on the website in a table. The details should contain the following: a) Snapshot of Cover Page b) Author Name c) Publisher. d) Price. e) Add to cart button.
- Design a timetable schedule for your current semester using the Table tag.
- Design a HTML page for Student Registration Form using Form Elements that includes Form, input-text, password, radio, checkbox, hidden, button, submit, reset, label, text area, select, option and file upload.
- Design a HTML web page with at least two <h1>, two images, two buttons, and appropriate CSS to display,
  a. All <h1> with font-size 12pt, and bold in Verdana font using Inline CSS.

b. All <img> with border color yellow, thickness 10px using Document Level CSS
c. All <input type='button'> should change background color to red on mouse over them using External CSS.

- Design a HTML page having a text box and four buttons viz Factorial, Fibonacci, Prime and Palindrome. When a button is pressed an appropriate java script function should be called to display the following:
  a. Factorial of that number
  b. Fibonacci series up to that number
  c. Prime numbers up to that number
  d. Is it palindrome or not?
- Design a web page that contains a color pallet, when the user moves the mouse to the particular area, then it changes the background color of the web page.
- Design a registration page to validate the following fields using Java Script
  a. Make sure the username starts with an uppercase letter
  b. The username must have at least one digit
  c. Ensure that Email is valid
  d. Ensure that the password length is between 8 to 20 characters
  e. Make sure the password contains at least one uppercase letter, one lower case, and one special character exclude [. (dot), ,(comma), ;(semicolon), : (colon)].
- Design a web application to validate entered username and password through JDBC connection program and display user information on successful login and provide profile editing option to the user. Else display an error message.
- Develop a JSP application to create a user on successful signup and update user information on successful login and display user information on the home screen and provide a logout button.
- Make an HTML form that collects the last name. Send the name to JSP page. If there is an employee with that last name, show full details of him or her (just show the first employee if there are multiple people with the same name). If there is no employee with that last name, say "no employee records available."

MODULE-2

UNIT–1 **8L+0T+8P=16Hours**

PHP:

Introduction to PHP, Expressions, and control flow in PHP, functions and objects, Arrays, Accessing MySQL using PHP, Form Handling, Cookies, Sessions, and Authentication.

UNIT-2 **8L+0T+8P=16Hours**

HTML 5 AND ANGULAR JS:

HTML 5: Introduction to HTML5, The HTML5 Canvas, HTML5 audio and Video.

AngularJS: Introduction, Expressions, Modules, Directives, Controllers, Filters, Events, Forms, Form Validation.

PRACTICES:

- Design a web page using PHP, upload image into web page and display image, when user clicking on view button.

- Design a personal Information form, Submit & Retrieve the form data using $_GET(), $_POST() and $_REQUEST() Variables.
- Design a login page to validate username and password through MySQL. If login is successful display user information on home page and modify user information on edit page using sessions. When user logged out, destroy all user-related sessions.
- Design a web page to accept payment data from user and do the payment, on successful payment display details on the screen. A Session should be set while doing payment up to 10 minutes after that link/payment page should be destroyed irrespective of user payment.
- Design a web page to display the videos on-page, on user selection using frames and HTML5 tags.
- Design a web page to display different types of objects using HTML5 Canvas.
- Design a web application to validate user registration page using AngularJS.
- Design a search engine using AngularJS. On keypress, display data on web page.

SKILLS:

- Perform client-side validation using JavaScript and Angular JS.
- Store and retrieve data using NodeJS.
- Generate dynamic webpages using JSP and PHP.
- Develop a web application or website for any real-time requirements.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Usage of HTML, HTML5, CSS, JavaScript, and PHP in web application development.	Apply	1, 2	1
2	Apply AngularJS features for form validation and NodeJS, and JDBC concepts to perform database operations from web pages.	Apply	1, 2	1
3	Analyse the suitability of NodeJS and JSP technologies to build solutions for real-world problems.	Analyse	2	2
4	Design and develop three-tier web applications using JSP, NodeJS, AngularJS, and PHP	Create	2	3

TEXT BOOKS:

1. Jon Duckett, "Beginning Web Programming with HTML, XHTML, and CSS", 2nd Edition, Wiley Publishing, Inc, 2008.
2. Robin Nixon, "Learning PHP, MySQL & JavaScript WITH JQUERY, CSS & HTML5", 4th edition, O'Reilly, 2015.

REFERENCE BOOKS:

1. Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet & World Wide Web How to Program", 5th edition, Pearson Education, 2012.
2. Kishori Sharon, "Java APIs, Extensions and Libraries with JavaFX, JDBC, jmod, jlink, Networking and the process API", 2nd Edition, Apress, 2018.

3. Brad Dayley, Brendan Dayley, and Caleb Dayley, “Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications,” 2nd edition, Pearson Education, 2018.
4. Steve Prettyman, “Learn PHP 7 Object Oriented Modular Programming using HTML5, CSS3, JavaScript, XML, JSON, and MySQL”, 1st edition, Apress, 2015.
5. Adrian W. West and Steve Prettyman, “Practical PHP 7, MySQL 8, and MariaDB Website Databases: A Simplified Approach to Developing Database-Driven Websites”, 1st edition, A Press, 2018.

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22EC855 - ANDROID OS AND APPLICATION DEVELOPMENT

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Any programming language with Oops concepts

COURSE DESCRIPTION AND OBJECTIVES:

The aim of the course is that the student will be able to develop android application using Java in Android Studio

MODULE-1

UNIT-1 **8L+0T+8P=16 Hours**

UNDERSTANDING ANDROID OS:

Android App Creation in Android Studio, Overview of the Android Architecture, The Anatomy of an Android Application, Overview of Android View Binding, Understanding Android Application and Activity Lifecycles

UNIT-2 **8L+0T+8P=16 Hours**

UNDERSTANDING STATES AND ACTIVITIES:

Handling Android Activity State Changes, Saving and Restoring the State of an Android Activity, Understanding Android Views, View Groups and Layouts, Android Constraint Layout, Android Touch and Multi-touch Event Handling

Implementing gestures and touch: Detecting Common Gestures Using the Android Gesture Detector Class, Implementing Custom Gesture and Pinch Recognition on Android,

PRACTICES:

- Develop an application that uses GUI components, Font and Colors.
- Develop an application that uses Layout Managers and event listeners.
- Develop a native calculator application.
- Write an application that draws basic graphical primitives on the screen.
- Develop an application that makes use of database.
- Develop an application that makes use of RSS Feed.

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

DESIGNING ANDROID COMPONENTS:

Modern Android App Architecture with Jetpack, An Android Jetpack View Model Tutorial, Working with the Floating Action Button and Snackbar, Creating a Tabbed Interface using the TabLayout Component

Working with intents and notifications:

Adding Sample Data to a Project, Working with the AppBar and Collapsing Toolbar Layouts, Overview of Android Intents, Android Explicit & Implicit Intents, Android Broadcast Intents and Broadcast Receivers, Overview of Android Services & Notifications, Foldable Devices and Multi-Window Support

UNIT-2 **8L+0T+8P=16 Hours**

ACCESSING STORAGE AND MULTIMEDIA:

An Android Storage Access Framework, Video Playback on Android using the VideoView and MediaController Classes, Making Runtime Permission Requests in Android, Android Audio Recording and Playback using MediaPlayer and MediaRecorder

Creating and testing android app:

Android App Links, Creating, Testing and Uploading an Android App Bundle

PRACTICES:

- Implement an application that implements Multi threading.
- Develop a native application that uses GPS location information.
- Implement an application that writes data to the SD card.
- Implement an application that creates an alert upon receiving a message.
- Write a mobile application that creates alarm clock.

COURSE OUTCOMES

At the end of the course, the student should be able to:

COs	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Identify and design the components for developing android applications	Apply	1	1, 2, 3, 4, 9, 10, 11, 12
2	Display notifications and access storage and multimedia in android OS	Apply	2	1, 2, 3, 4, 9, 10, 11, 12
3	Implement basic states, gestures for Android applications	Create	1	1, 2, 4, 9, 10, 11, 12
4	Design an android app for a given need	Create	2	1, 2, 3, 4, 9, 10, 11, 12

TEXT BOOKS:

1. Smyth, Neil, "Android Studio 4. 2 Development Essentials - Java Edition**",** 2021
2. Wei-Meng Lee, "Beginning Android 4 Application Development", 1st edition, Wiely Publishers, 2011.

REFERENCE BOOKS:

1. Prasanna Kumar Dixit, "Android", 1st edition, Vikas Publishers, 2014.
2. Jerome (J.F.) DiMarzio, "Android - A programmers Guide", 1st edition, Tata Mc Graw Hill, 2010.
3. Reto Meier, "Professional Android 4 Application Development", 1st edition, Wiley Publishers, 2008
4. John Horton, "Android Programming for Beginners", 1st edition, Pact Publishing, 2015.

Source; https://www.elprocus.com/what-is-android-introduction-features-applications/

22EC856 - INTERNET OF THINGS

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basics of Internet

COURSE DESCRIPTION AND OBJECTIVES:

This course introduces the introduction to Internet of Things and the basic concepts. The course emphasizes design issues and utilization of IoT devices, including various sensors and hardware boards.

MODULE-1

UNIT-1 **8L+0T+8P=16 Hours**

INTRODUCTION & CONCEPTS:

Introduction to Internet of Things, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels

UNIT-2 **8L+0T+8P=16 Hours**

INTERNET PRINCIPLES:

Internet Communications: An Overview, IP Addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols, Python packages of interest for IoT.

Domain Specific Applications of IoT: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style.

PRACTICES:

- Familiarization of various hardware boards.
- To analyze the IP address of Personal Computer
- Working principles of various IoT protocols.
- Implementation of MQTT protocol using Arduino board
- Python packages for implementing IoT applications

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

INTERNET PRINCIPLES & M2M:

M2M: Introduction to M2M, M2M architecture, Difference between IoT and M2M, SDN and NFV for IoT.

IEEE 802.15.4: Physical layer, MAC layer, Uses and future of 802.15.4.

Zigbee: Architecture, Association, Network layer, APS layer and security.

Z-Wave: Z-wave Protocol.

UNIT-2 **8L+0T+8P=16 Hours**

CASE STUDY & ADVANCED IOT APPLICATIONS:

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments.

Case study illustrating IoT design: Home Automation, Smart Cities, Environment, Agriculture, Productivity Applications.

PRACTICES:

- Interfacing of LED and switch with Arduino boards and ESP8266.
- Traffic Light control using Arduino board and ESP8266.
- Interfacing DHT11 sensor with Arduino board and ESP8266.
- Interfacing of ultrasonic sensor with Arduino board and ESP8266.
- Interfacing of PIR sensor with Arduino board and ESP8266.
- DC motor control using L293D motor driver and Arduino board.
- Familiarization with Raspberry pi.
- Interfacing of LED and switch with Raspberry pi.
- Interfacing PIR sensorwith Raspberry pi.
- Interfacing DHT11 sensor with Raspberry pi.
- Interfacing of ultrasonic sensor with Raspberry pi.
- Interfacing of Picam with Raspberry pi.

SKILLS:

- Understand the specifications and how well different components work together using IoT.
- Learn above different sensors for collecting data.
- Design a prototype for various IoT applications.

COURSEOUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Able to programs for IoT applications.	Apply	1	1, 2, 12
2	Able to design the framework necessary for IoT applications	Apply	1	1, 2, 5, 12
3	Able to develop prototypes for IoT devices	Apply	1	1, 2, 3, 5, 12
4	Categorize various IoT applications	Apply	2	1, 2, 12
5	Classify various advanced IoT applications and case studies.	Apply	2	1, 2

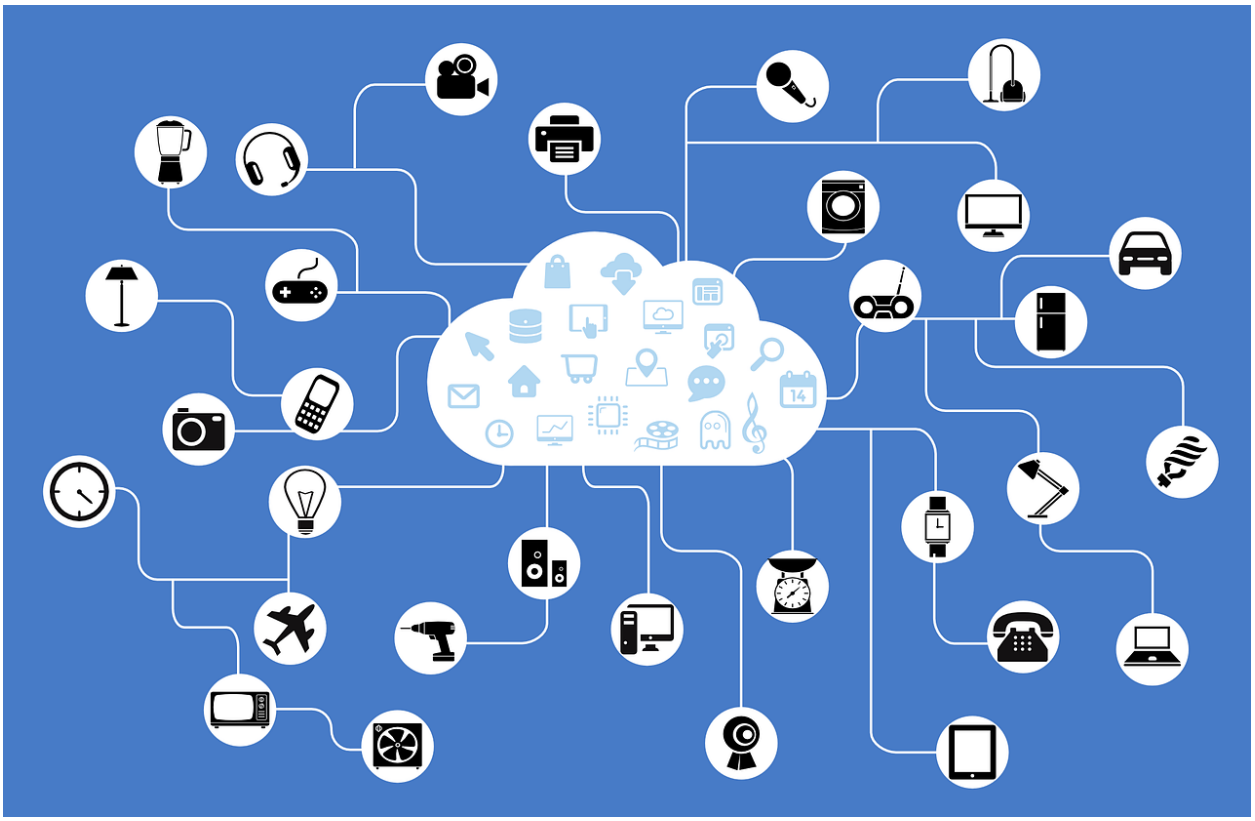
TEXT BOOKS:

1. Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On- Approach", 2014,
2. Adrian McEwen, "Designing the Internet of Things", Wiley Publishers, 2013,

REFERENCE BOOKS:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013.
2. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1.

3. Kamal R. Internet of Things, McGraw Hill, 2017.



Source: https://www.rtsrl.eu/blog/what-is-internet-of-things-iot/

22EC857 - INTRODUCTION TO EMBEDDED SYSTEMS

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Computer Architecture and Organization, Microprocessors and Microcontrollers.

COURSE DESCRIPTION AND OBJECTIVES:

The course objective is to study the applications, categories, hardware and software architectures, memory, testing tools in embedded systems, Firmware, Embedded C, operating system functions and various kernel objects and RTOS.

MODULE-1

UNIT-1 **6L+0T+6P=12 Hours**

INTRODUCTION:

Basic concepts, Applications and Categories of embedded systems, Hardware architecture, Software architecture of Embedded Systems, Process of generating executable images, Development/testing tools.

UNIT-2 **10L+0T+10P=20 Hours**

PROGRAMMING:

Comparison of Assembly and C languages, C and Embedded C. Programming in C: Arrays, Structures, Loops and Decisions, Pointers, Functions, Embedded C: Header files for Project and Header files for Port.

PRACTICES:

- Programming with Embedded C using any compiler.
- Demonstration/Practical session for creation of header files.
- Program to create loops in Embedded C
- Program to implement decisions in Embedded C
- Develop program to implement interrupt function

MODULE-2

UNIT-1 **6L+0T+6P=12 Hours**

OPERATING SYSTEMS:

Introduction to Operating Systems, Process and threads, Scheduling, Non-preemptive and Preemptive scheduling, Real Time Scheduling.

UNIT-2 **10L+0T+10P=20 Hours**

REAL TIME OPERATING SYSTEMS:

Introduction to Real Time Operating Systems, Shared Data Problem, Semaphores, Priority inversion problem, Inter process/task communication techniques.

PRACTICES:

- Create and schedule a process/task
- Demonstrate shared data problem
- Create and use semaphores
- Find schedulability using Gantt charts
- Implement IPC techniques

SKILLS:

- Choose component for Embedded System
- Understand operating system concepts
- Understand

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

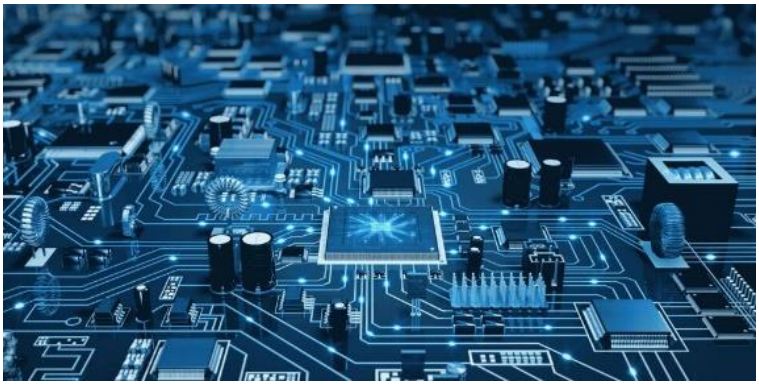
CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Choose necessary component and buses for the embedded system	Apply	2	1, 2, 3, 4, 9, 10, 11, 12
2	Apply the knowledge of operating system functions and various kernel objects	Apply	2	1, 2, 3, 4, 9, 10, 11, 12
3	Identify the components of embedded systems and differentiate various embedded systems	Analyze	1	1, 2, 3, 4, 9, 10, 11, 12
4	Design embedded systems using standard procedure	Create	1	1, 2, 3, 4, 9, 10, 11, 12

TEXT BOOKS:

1. Raj Kamal, "Embedded Systems Architecture, Programming and Design", 3rd edition, Mc Graw Hill, 2017.
2. Lyla B. Das, "Embedded Systems An Integrated Approach," Pearson Education, 2013

REFERENCE BOOKS:

1. Marilyn wolf, "Computers as Components: Principles of Embedded Computer systems design", 4th edition, Morgan Kaufmann Publishers, 2017.
2. Dr. K.V.K.K. Prasad, "Embedded Real time Systems", Black book, Dreamtech Press, 2003.
3. Daniel W. Lewis, "Fundamentals of Embedded Software: Where C and Assembly Meet", 1st edition, Pearson, 2001.
4. John Catsoulis, "Designing Embedded Hardware", 2nd Edition, O'Reilly Media, Inc., 2005.
5. "Getting Started with Arduino: The Open Source Electronics Prototyping Platform", 3rd edition, Maker Media Inc., 2015.



Source: https://cprimestudios.com/blog/5-myths-about-embedded-systems-development

22EC858 - MICROPROCESSORS AND MICROCONTROLLERS

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Digital Electronics

COURSE DESCRIPTION AND OBJECTIVES:

This course introduces the principles of microprocessors and microcontrollers. It also deals with the programming concepts of microprocessors and microcontrollers.

MODULE-1

UNIT-1 **6L+0T+6P=12 Hours**

8086 MICROPROCESSOR:

Architecture, Flag register, Signals, Memory segmentation, Physical address generation, Minimum mode, Maximum mode, Interrupts, Memory organization.

UNIT-2 **10L+0T+10P=20 Hours**

8086 INSTRUCTIONS:

Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, String instructions, machine control instructions; Addressing Modes, Assembler directives, Procedures and macros.

PRACTICES:

- Introduction to TASM software.
- 8-bit, 16-bit Addition, Subtraction.
- 8-bit, 16-bits Multiplication and Division.
- Find square, cube and square root.
- Find number of zeros and ones, Separate the 10s and 1s of a given 8-bit number.
- Searching a number, Find and replace the number in a given array.
- Convert Hexa to BCD and Hexa to ASCII.
- Factorial, sum of n numbers, average of n numbers.
- Find the smallest/largest number, Arrange the given numbers in sorting order.
- Block transfer using string instructions.
- Display of character/ string on console using DOS INT 21H function calls.
- File management using DOS INT 21H function calls.

MODULE-2

UNIT-1 **6L+0T+6P=12 Hours**

8051 MICROCONTROLLERS:

Comparing Microprocessors and Microcontrollers; Selection of Microcontrollers, Architecture, PSW, Signals, Memory organization, Instruction set, Addressing modes of 8051.

UNIT-2 **10L+0T+10P=20 Hours**

8051 COMPONENTS:

On-chip Components: Parallel Ports, Timers/Counters, Serial port, Interrupts. Interfacing with 8051: LCD, Keyboard, Stepper Motor.

PRACTICES:

- Introduction to Keil vision 4 software,
- Addition, Subtraction, Multiplication and Division.
- Find number of zeros and ones, Separate the 10s and 1s of a given 8bit number.
- Factorial, sum of n numbers, average of n numbers.
- Find the smallest/largest number, Arrange the given numbers in sorting order.
- Addition, Subtraction, Reverse subtraction.
- Find number of zeros and ones, Separate the 10s and 1s of a given 8bit number.
- Factorial, sum of n numbers, average of n numbers.
- Find the smallest/largest number, Arrange the given numbers in sorting order.
- Blinking of LED's, Reading Switches and Glowing LED's using Assembly and C.
- 7 segment LED with 8051.
- LCD module with 8051.
- Stepper motor speed and rotation control using 8051.
- Waveform generation using DAC with 8051.

SKILLS:

- Understand the specifications and how well different components work together for a processor.
- Visualize the differences between microprocessor and microcontroller
- Develop programs for Microcoprocessor and micorocotnroller

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

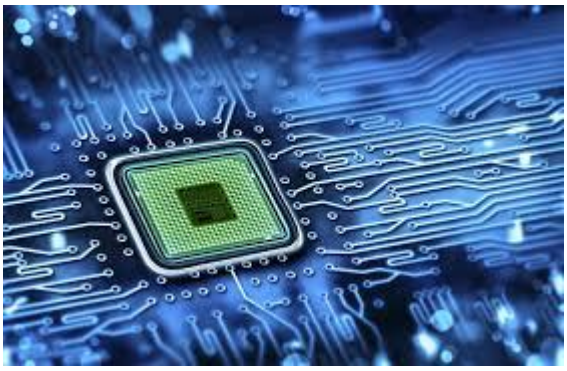
CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Architect a microprocessor or microcontroller system and estimate the required hardware and software resources.	Apply	1	1, 2, 3, 4, 9, 10, 11, 12
2	Write assembly language program in 8086 for various applications.	Apply	1	1, 2, 3, 4, 9, 10, 11, 12
3	Write assembly language program in microcontroller 8051 for various applications	Apply	2	1, 2, 3, 4, 9, 10, 11, 12
4	Select a microprocessor or microcontroller suitable to the application.	Analyse	1	1, 2, 3, 4, 9, 10, 11, 12
5	Create the memory and IO interfacing techniques 8051.	Create	2	1, 2, 3, 4, 9, 10, 11, 12

TEXT BOOKS:

1. Kenneth J. Ayala, "The 8086 Microprocessor: Programming and Interfacing the PC", 3rd edition, Cengage Learning, 2007.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D.Mckinlay, "The 8051 Microcontroller and Embedded Systems", 2nd edition, Pearson Education, 2012.

REFERENCE BOOKS:

1. Barry B. Brey, "The Intel microprocessors 8086/8088, 80186/80188, 80286, 80386,80486, Pentium, Pentium Pro processor, Pentium II, Pentium III, Pentium 4, and Core2 with 64-bit extensions: architecture, programming, and interfacing", 8th edition, Pearson Prentice Hall, 2014.
2. Yu Cheng Liu and Glenn A Gibson, "Microcomputer Systems: The 8086/8088 Family Architecture Programming and Design", 2nd edition, Prentice Hall, 2015.
3. Kenneth J. Ayala, "The 8051 Microcontroller: Architecture Programming and Applications", 3rd edition, Cengage Learning, 2008.
4. K. M. Bhurchandi and A. K. Ray, Advance Microprocessor and Peripherals, 3rd edition, Tata McGraw Hill, 2017.



Source:
https://www.google.com/search?q=Microcontroller&sxsrf=ALiCzsbnrzqS2pUyMf6IF_RBKdnsYzQ7gA:1661497159591&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiWj_if9-P5AhVMm9gFHf8VAeEQ_AUoAnoECAIQBA&biw=1280&bih=512&dpr=1.5

22EC859 - SMART & VIRTUAL INSTRUMENTATION

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basic understanding of Sensors, any programming language concepts

COURSE DESCRIPTION AND OBJECTIVES:

To familiarize students with the smart and intelligent sensors with VI software. Acquire knowledge on Data Acquisition Systems and network interface concepts. Understand various analysis tools and develop programs for Industrial Applications

MODULE-1

UNIT-1 **8L+0T+8P=16 Hours**

INTRODUCTION TO VIRTUAL INSTRUMENTATION:

Computers in Instrumentation, Virtual Instrumentation (VI), LabVIEW and VI, Conventional and Graphical Programming, Components of LabVIEW, Owned and Free Labels, Tools and Other Palettes, Arranging Objects, Pop-Up Menus, Color Coding, Code Debugging.

UNIT-2 **8L+0T+8P=16 Hours**

VI PROGRAMMING TECHNIQUES:

VIs and sub-VIs, Loops and Charts, Arrays, Clusters and graphs, Case and sequence structures, Formula nodes, Local and global variables, Strings and file I/O.

Data Acquisition System: Measurement and Automation Explorer, The Waveform Data Type, Working in DAQmx, Working in NI-DAQ(Legacy DAQ), Use of Simple VIs, Intermediate VIs.

PRACTICES:

- Introduction to LabVIEW
- Use of NI Elvis
- Use of SubVI
- Formula node
- Shift registers
- Array, Strings
- Function Generator
- DC voltage measurement using DAQ

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

INTERFACING INSTRUMENT:

GPIB and RS232: RS232C versus GPIB, handshaking, GPIB interfacing, RS232C/RS485 interfacing, Standard commands for programmable instruments, VISA, Instrument interfacing and LabVIEW.

UNIT-2 **8L+0T+8P=16 Hours**

INTERFACING SMART SENSORS:

Introduction, Classification, Smart Sensors, Cogent Sensors, Soft or Virtual Sensors, Self Adaptive Sensors, Self-Validating Sensors, VLSI Sensors, Temperature Compensating Intelligent Sensors. Film sensors (Thick film sensors, this film sensor), MEMS and Nano-Sensors.

PRACTICES:

- Analog Input and Output Interface
- Frequency Measurement
- Network Interface
- Thermocouple Interface and Celsius to Fahrenheit conversion
- Stepper Motor
- Simulation of Tank Process
- Clusters
- PID controller for DC motor

COURSE OUTCOMES

At the end of the course, the student should be able to:

COs	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Develop systems for real-time signal acquisition and analysis.	Apply	2	1, 2, 3, 4, 9, 10, 11, 12
2	Interface physical parameters with computer through data acquisition systems for practical applications	Apply	2	1, 2, 3, 4, 9, 10, 11, 12
3	Analyze the basic concept of smart sensors, virtual instrument.	Analyze	1	1, 2, 4, 9, 10, 11, 12
4	Create a Virtual Instrument using graphical programming	Create	1	1, 2, 3, 4, 9, 10, 11, 12
5	Apply concepts of network interface for data communication.	Create	2	1, 2, 3, 4, 9, 10, 11, 12

TEXT BOOKS:

1. Dr. Sumathi. S and Prof. Surekha. P, “LabVIEW Based Advanced Instrumentation Systems”, 2nd edition, 2007.
2. Jovitha Jerome, “Virtual Instrumentation using LabVIEW”, PHI Learning Pvt. Ltd, New Delhi, 2010.

REFERENCE BOOKS:

1. Lisa .K, Wells and Jeffrey Travis, “LABVIEW for Everyone”, Prentice Hall, 2009.
2. Skolkoff, “Basic concepts of LABVIEW 4”, PHI, 1998.
3. Gupta. S, Gupta. J.P, “PC Interfacing for Data Acquisition and Process Control”
4. Gary Johnson, “LabVIEW Graphical Programming”, McGraw Hill, 2006.

Source: https://new.siemens.com/uk/en/products/automation/process-instrumentation/smart-instruments.html

22EC860 - WIRELESS SENSOR NETWORKS

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basics of computer networks

COURSE DESCRIPTION AND OBJECTIVES: This course is targeted at understanding and obtaining hands-on experience with the state of the art in such wireless sensor networks which are often composed using relatively inexpensive sensor nodes that have low power consumption, low processing power and bandwidth. Explore the various MAC routing protocols evolved in wireless sensor networks.

MODULE-1

UNIT- 1 **8L+0T+8P=16hours**

INTRODUCTION:

Introduction to Wireless Networks, Protocol Suites, and Standards, OSI Model and TCP/IP Protocol Suite, Ad-hoc Networks, Comparison of Ad-hoc and Sensor Networks, applications of WSNs, challenges for WSNs, hardware components of wireless sensor node, energy consumption of a sensor nodes, operating system and execution environments and examples of sensor nodes.

UNIT-2 **8L+0T+8P=16hours**

NETWORK ARCHITECTURE AND PHYSICAL LAYER:

Sensor network scenarios, optimization goals and figures of merit, design principles for wireless sensor networks, service interfaces for wireless sensor networks, gateway concepts, wireless channel and communication fundamentals, physical layer, and transceiver design considerations in wireless sensor networks.

MODULE-2

UNIT-1 **8L+0T+8P=16hours**

MAC LAYER PROTOCOLS FOR WIRELESS SENSOR NETWORKS:

Fundamentals of wireless MAC protocols, Low duty cycle protocols and wakeup concepts, contention-based protocols, schedule- based protocols, IEEE 802.15.4 MAC protocols, error control and link layer management.

UNIT-2 **8L+0T+8P=16hours**

ROUTING PROTOCOLS FOR WIRELESS SENSOR NETWORKS:

The forwarding and routing concept, Gossiping and agent-based unicast forwarding, energy efficient unicast methods, broadcast and multicast methods, geo-graphic routing methods and mobile nodes, TEEN, APTEEN and SPIN protocols.

PRACTICES:

- Experiments to be carried out in any network simulator like NETSIM, NS2 and OMNET++ etc.
- Examine the various path loss models available for wireless networks
- Identify the various reasons for hidden node terminal problem in wireless ad-hoc networks.

- Create a scenario where both ad-hoc and wireless sensor network are available and examine the interference problem.
- Simulate the MAC routing protocols for wireless sensor networks.
- Simulate the multiple wireless scenarios for throughput performance.
- Analyze performance of the hierarchical routing protocols in various parameters like end-to-end delay, bit error rate and throughput.
- Design a wireless sensor network and observe how the power consumption consumed for the network.
- Examine the importance of channel accessing mechanism helped for getting high throughput in wireless networks.

SKILLS:

- Able to adapt the wireless sensor network with sensor nodes which have limitations in power consumption, processing power and bandwidth.
- Able to specify the requirements for the hardware and software solutions for energy-efficient sensor network for new applications.
- Able to apply appropriate algorithms to improve existing or to develop new wireless sensor network applications

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyze the various solutions involved for designing WSN	Analyze	1	1, 2, 4, 9, 10, 11, 12
2	To identify the Wireless Sensor Network node architecture and real time nodes.	Apply	1	1, 2, 3, 4, 9, 10, 11, 12
3	Analyze the performance of Medium Access Control protocols for power consumption, fairness, channel utilization and control packet overhead.	Analyze	2	1, 2, 3, 4, 9, 10, 11, 12
4	Evaluate the performance of routing protocols for wireless sensor network.	Evaluate	2	1, 2, 3, 4, 9, 10, 11, 12

TEXT BOOKS:

1.Holger Karl, Andreas Willig "Protocols and Architecture for Wireless Sensor Networks" John Wiley and Sons, Ltd, 2007

2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication, 2002.

REFERENCES BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004.
2. Kazem sohraby, Daniel Minoli and Taieb Znati, "Wireless Sensor Networks: Technology, Protocols and Application" John Wiley, 2007.

3. C.K Toh, “Ad-Hoc Mobile Wireless Networks: Protocols and Systems” 1st edition, Pearson, 2007.

Source: https://www.smart-energy.com/magazine-article/wireless-sensor-network-tech-iiot/

22EE851 - FUNDAMENTALS OF SOLAR CELLS

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basics Physics

COURSE DESCRIPTION AND OBJECTIVES:

This course is aimed at familiarizing the students with the characteristics of solar radiation, its global distribution, and measurement of solar radiation. In this subject students will learn the fundamentals, characteristics, parameters and types of solar PV cells.

MODULE–1

UNIT-1 **8L+8T+0P=16 Hours**

SOLAR RADIATION AND MEASUREMENT:

Indian energy scenario, Global solar resources, solar radiation on the earth surface, solar radiation measuring instruments, Local apparent time.

UNIT-2 **8L+8T+0P=16 Hours**

SOLAR RADIATION GEOMETRY AND CALCULATIONS:

Solar radiation geometry, sun-earth angles, calculation of angle of incidence, solar day length, angstroms equation.

PRACTICES:

- Estimate the amount of solar energy intercepted by the Earth.
- Measure the solar radiations on a given day and plot the hourly variations.
- Predict the variation of solar radiation with day of a year.
- Calculate the variation of sun-earth angles with day of a year.
- Effect of variation in tilt angle on PV module power.

MODULE–2

UNIT-1 **10L+8T+0P=18 Hours**

SOLAR CELL FUNDAMENTALS:

Photovoltaic effect, solar cell structure. Parameters of a solar cell, parasitic resistances, I-V characteristics, effect of irradiation and temperature.

UNIT-2 **6L+8T+0P=14 Hours**

EMERGING SOLAR CELL TECHNOLOGIES:

Silicon solar cells, Thin film solar cells, Multi junction solar cells, Organic solar cells, Dye-synthesized solar cells, Thermo Photovoltaics, Concentrated Photovoltaics

PRACTICES:

- Measurement of Voltage and Current of Solar Cells.
- Obtain the I-V and P-V characteristics of PV cell.
- Demonstrate the I-V and P-V characteristics of PV cell with varying radiation level.

- Demonstrate the I-V and P-V characteristics of PV cell with varying temperature level.

SKILLS:

- Prioritizing the usage of solar radiation measuring instruments.
- Calculate different sun-earth angles.
- Analyze the performance of PV cell looking at its I-V characteristics.
- Interpret the effect of various parameters on the performance of a solar cell.
- Predict the variation of solar radiation with day of a year.
- Validate the I-V curves of a solar cell at different radiation levels.
- Validate the I-V curves of a solar cell for varying temperatures.
- Fabricate a solar powered LED light.

COURSE OUTCOMES:

Upon successful completion of this course, students will have to ability to:

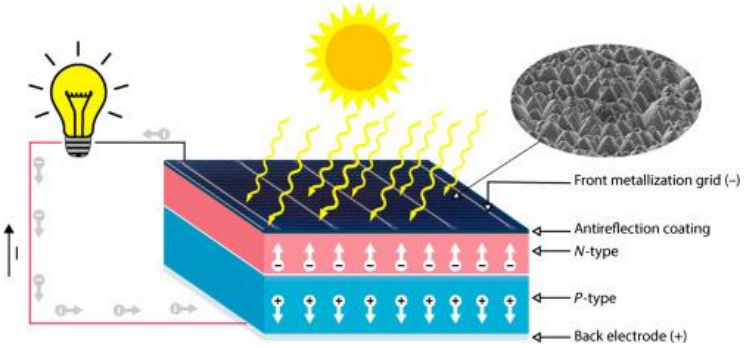
CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Prediction of solar radiation on a particular day	Analyze	1	1,2,3,4,6,7
2	Analyze the effect of various parameters on the performance of a solar cell	Analyze	1,2	1,2,3,4,5,6,7
3	Choosing the instrument for measuring the relevant solar radiation data	Evaluate	1	1,2,4,5,6,7
4	Review the different emerging solar cell technologies	Evaluate	1,2	1,2,4,5,6,7

TEXT BOOKS:

1. Chetan Singh Solanki., Solar Photovoltaic: "Fundamentals, Technologies and Application", PHI Learning Pvt., Ltd., 2009.
2. Sukhatme .S.P, Nayak .J.K, "Solar Energy", Tata McGraw Hill Education Private Limited, New Delhi, 2010.

REFERENCE BOOKS:

1. Chetan Singh Solanki., "Solar Photovoltaic Technology and Systems: A Manual for Technicians" PHI Learning Pvt., Ltd., 2013.
2. Jha .A.R, "Solar Cell Technology and Applications", CRC Press, 2010.



Source: https://www.sciencedirect.com/science/article/pii/B9780128133378000011

22EE852 - SOLAR PHOTOVOLTAIC SYSTEMS

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basics Physics, Basics of Electrical & Electronics Engineering.

COURSE DESCRIPTION AND OBJECTIVES:

This course is aimed at familiarizing the students with the design aspects of solar cell, series and parallel connection of solar cells, I-V characteristics of a PV module. In this subject students will learn the sun tracking mechanisms, battery energy storage and PV system applications.

MODULE–1

UNIT-1 **6L+6T+0P=12 Hours**

DESIGN ASPECTS OF SOLAR CELLS:

Design of solar cells, Design for high I_{sc}, Design for high V_{oc}, Design for high Fill factor, Quantum efficiency.

UNIT-2 **10L+10T+0P=20 Hours**

SOLAR PV MODULE:

Series and parallel connection of solar cells, shading, hot spots, ratings and I-V characteristics of a PV module, bypass diode and blocking diode.

PRACTICES:

- Demonstrate the I-V and P-V characteristics of PV module with varying radiation and temperature level
- Demonstrate the I-V and P-V characteristics of series and parallel combination of PV modules.
- Demonstrate the effect of shading on module output power.
- Demonstrate the working of diode as bypass diode and blocking diode in a PV module.

MODULE–2

UNIT-1 **10L+8T+0P=18 Hours**

MAXIMUM POWER POINT TRACKING:

Sun tracking – single and dual axis tracking, concept of MPPT technique and introduction to algorithms.

UNIT-2 **6L+8T+0P=14 Hours**

BATTERY ENERGY STORAGE AND PV SYSTEM APPLICATIONS:

Battery Energy Storage: Charging and discharging of a battery**,** Battery performance curves, Types of batteries, Battery terminology.

PV System Applications: Building-integrated photovoltaic units, solar lamps, solar street lights, solar water pumps, solar cars, aircraft, space solar power satellites.

PRACTICES:

- Obtain the charging and discharging characteristics of a battery.
- Calculate the MPP manually by varying the resistive load across the PV panel.
- Calculate the MPP by varying the duty cycle of DC-DC converter.
- Review the various applications of PV system.

SKILLS:

- Distinguish between series and parallel combination of PV modules.
- Analyze the effect of shading on module output power.
- Analyze the different MPPT algorithms.
- Choosing the type of a battery for a particular application.
- Validate the I-V curves of a solar module at different radiation levels.
- Validate the I-V curves of a solar module for varying temperatures.
- Obtain the I-V and P-V characteristics of series and parallel combination of PV modules
- Obtain the charging and discharging characteristics of a battery.

COURSE OUTCOMES:

Upon successful completion of this course, students will have to ability to:

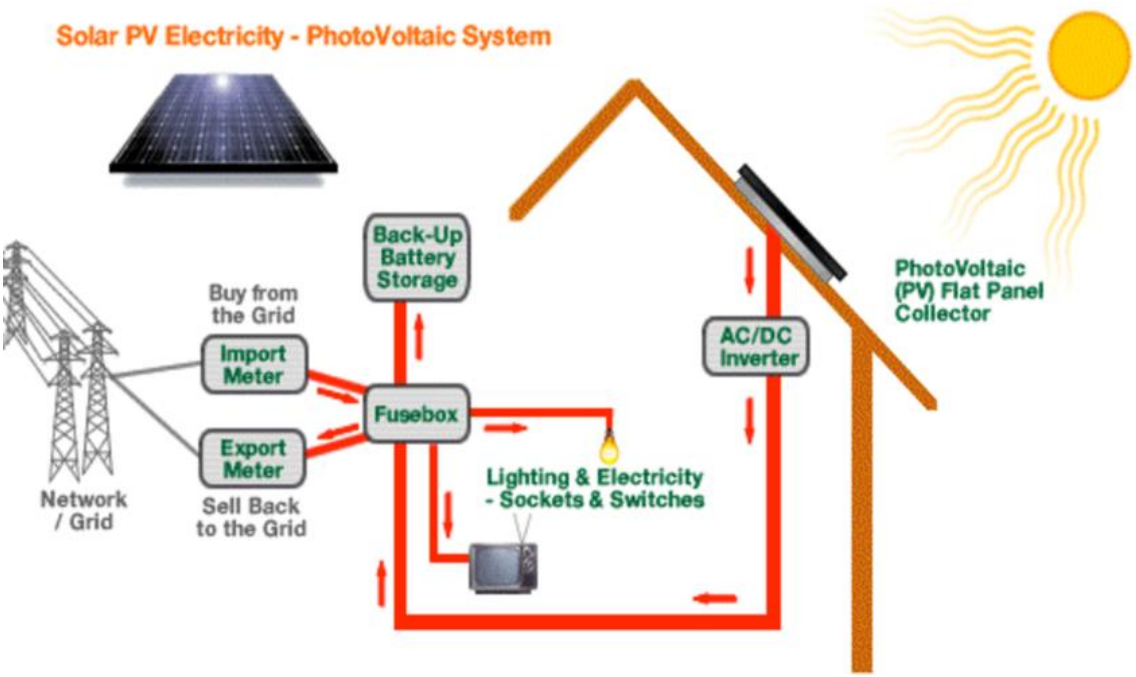
CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyze the effect of optimizing the parameters on the performance of a solar cell	Analyze	1	1,2,3,4,5,6,7
2	Analyze the effect of various parameters on the performance of a solar module	Analyze	1,2	1,2,3,4,5,6,7
3	Analyze the different MPPT algorithms.	Analyze	1,2	1,2,3,4,5,6,7.9.12
4	Review the various applications of PV system.	Evaluate	2	1,2,4,5,6,7

TEXT BOOKS:

1. Chetan Singh Solanki., Solar Photovoltaic: "Fundamentals, Technologies and Application", PHI Learning Pvt., Ltd., 2009.
2. Jha .A.R, "Solar Cell Technology and Applications", CRC Press, 2010.

REFERENCES:

1. Chetan Singh Solanki., "Solar Photovoltaic Technology and Systems: A Manual for Technicians" PHI Learning Pvt., Ltd., 2013.
2. Sukhatme.S.P, Nayak .J.K, "Solar Energy", Tata McGraw Hill Education Private Limited, New Delhi, 2010.
3. John R. Balfour, Michael L. Shaw, Sharlave Jarosek., "Introduction to Photovoltaics", Jones & Bartlett Publishers, Burlington, 2011.



Source: https://www.researchgate.net/figure/Fig-1-Schematic-example-of-a-solar-Photovoltaic-system-13_fig1_252592087

22EE853 - DESIGN AND ECONOMICS OF SOLAR PV SYSTEMS

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basic Physics, Basics of Electrical & Electronics Engineering

COURSE DESCRIPTION AND OBJECTIVES:

This course is aimed at familiarizing the students with the classification and design of PV system applications. The objective of the course is to introduce economic tools, empirical data for economic analysis in the energy system domain to support and influence the decision making in the context of resource planning and energy efficiency to take economically sound decisions.

MODULE–1

UNIT-1 **8L+8T+0P=16 Hours**

COMPONENTS OF PV SYSTEMS:

Classification of PV systems, small system for consumer applications, Hybrid solar PV system, PV system components – charge controller, solar inverter, net metering system.

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UNIT-2 **8L+8T+0P=16 Hours**

DESIGN OF PV SYSTEM:

Design of PV system for street lighting, water pumping and residential applications.

PRACTICES:

- Workout power flow calculations of standalone PV system of DC load with and without battery.
- Workout power flow calculations of standalone PV system of AC load with and without battery.
- Workout power flow calculations of standalone PV system of DC and AC load with and without battery.
- Design a solar PV system for a residential application.

MODULE–2

UNIT-1 **8L+8T+0P=16 Hours**

INTRODUCTION TO ENERGY ECONOMICS:

Need of Energy Economics, break even Analysis, time value of money, Effective Interest Rate, NPV, IRR, BCR.

UNIT-2 **8L+8T+0P=16 Hours**

ECONOMIC ANALYSIS:

Payback period, Life cycle costing, Annualized Life cycle costing, Unit cost of power generation from different sources.

PRACTICES:

- Case study on make or buy decision.
- Case study on economical comparison of solar PV and diesel power generation.
- Case study on replacement and maintenance analysis.
- Life cycle analysis of solar panel.

SKILLS:

- Design a solar PV system for a particular application.
- Compare various available financial alternatives.
- Perform replacement and maintenance analysis.
- Perform life cycle analysis of a product.
- Economical comparison of solar PV and diesel power generation.

COURSE OUTCOMES:

Upon successful completion of this course, students will have to ability to:

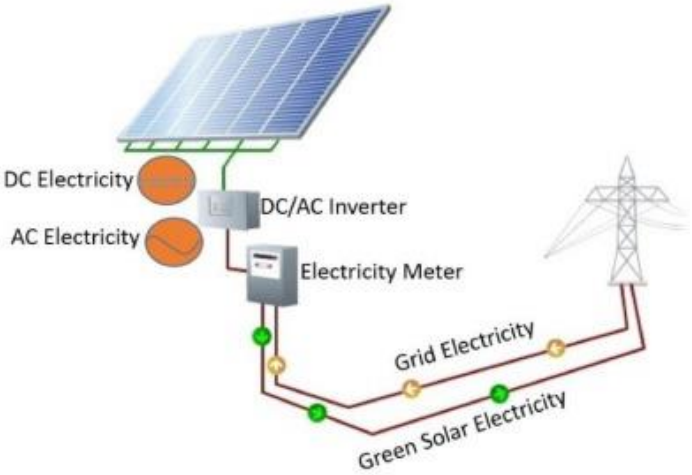
CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Classify the Solar PV systems based on requirements	Analyze	1	1,2,4,6,7
2	Analyze financial and economic concepts for a given problem.	Analyze	2	1,2,3,4,11
3	Evaluate different alternatives for better economic efficiency.	Evaluate	2	1,2,3,4,11
4	Design a Solar PV system	Create	1	1,2,3,4,5,6, 7.9.12

TEXT BOOKS:

1. Chetan Singh Solanki., Solar Photovoltaic: "Fundamentals, Technologies and Application", PHI Learning Pvt., Ltd., 2009.
2. Panneer Selvam, R, "Engineering Economics", 2nd edition, Prentice Hall of India Ltd, New Delhi, 2013.

REFERENCES:

1. Chetan Singh Solanki., "Solar Photovoltaic Technology and Systems: A Manual for Technicians" PHI Learning Pvt., Ltd., 2013.
2. Subhes C.Bhattacharyya., "Energy Economics", Springer, 2011.
3. Sukhatme .S.P, Nayak .J.K, "Solar Energy", Tata McGraw Hill Education Private Limited, New Delhi, 2010.



Source: https://www.sciencedirect.com/science/article/pii/S2405653717300350

22EE854 - SOLAR THERMAL ENERGY CONVERSION SYSTEMS

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Engineering Physics

COURSE DESCRIPTION AND OBJECTIVES:

This course is aimed at familiarizing the students with principles of operation, structure, testing and installation of major types of solar thermal collectors. In this subject students will earn the knowledge solar thermal energy storage.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

BASICS OF HEAT ENERGY AND HEAT TRANSFER:

Modes of heat transfer, Basic laws of heat transfer, Laws of thermodynamics.

UNIT-2 **8L+8T+0P=16 Hours**

SOLAR COLLECTORS:

Fundamentals of solar collectors, flat plate collectors, evacuated tube collectors, solar air heaters, Line-focusing concentrators, point-focusing concentrators, Sun tracking mechanisms.

PRACTICES:

- To study the constructional details of a box type solar cooker
- Study of Solar Water Heater
- To study the constructional details of Evacuated tube solar collector

MODULE – 2

UNIT-1 **8L+8T+0P=16 Hours**

SOLAR ENERGY STORAGE:

Sensible heat storage, latent heat storage, thermochemical storage, solar pond energy storage.

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATIONS OF SOLAR COLLECTORS:

Solar thermal power generation technologies, water heating, space heating, drying, desalination, solar cooker.

PRACTICES:

- To study solar pond
- To study solar distillation
- Study of Forced circulation solar water heating system

SKILLS:

- Understand the fundamentals of solar flat plate collectors.

- Understand the fundamentals of concentrating solar collectors.
- Familiar with the solar low, medium and high temperature applications.

COURSE OUTCOMES:

Upon successful completion of this course, students will have to ability to:

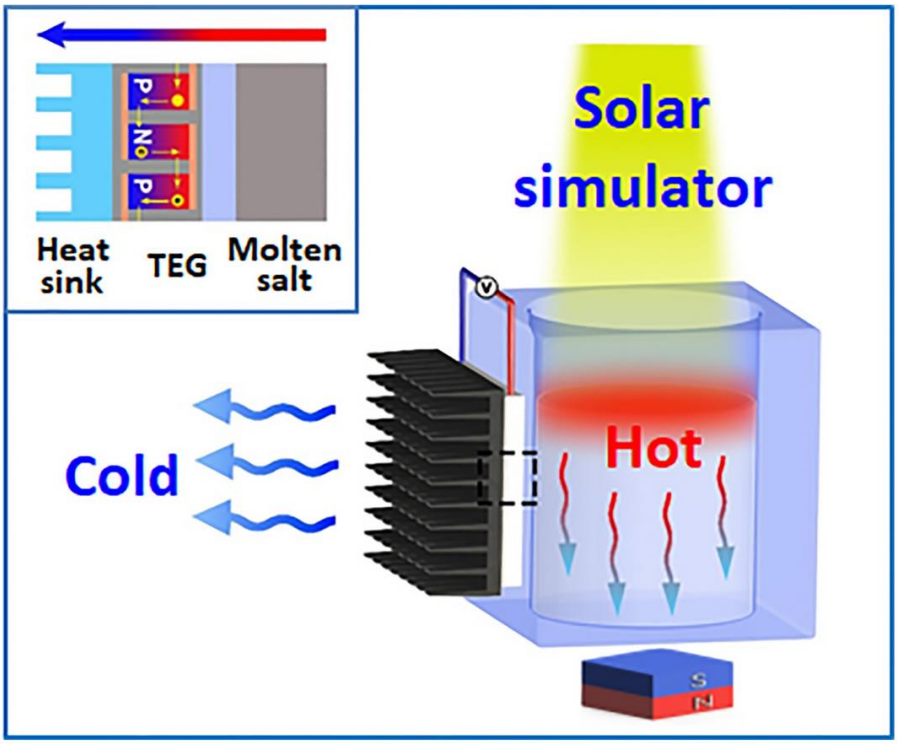
CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Design solar flat plate collectors.	Apply	1	1,4,5,6,7,11
2	Design concentrated type thermal collectors	Apply	1	1,4,5,67,11
3	Compare different thermal storage technologies	Analyze	2	1,4,5,67,11
4	Analyze various solar passive building techniques for cooling and heating applications	Analyze	2	1,4,5,67,11

TEXT BOOKS:

1. Sukhatme .K, Suhas P.Sukhatme., "Solar energy: Principles of thermal collection and storage", Tata McGraw Hill publishing Co. Ltd, 8th edition, 2008.
2. Yogi D. Goswami, Frank Kreith, Jan F.Kreider., "Principle of solar engineering", 2nd edition, Taylor and Francis, 2nd edition, 2003.

REFERENCE BOOKS:

1. R.K.Rajput,"Heat And Mass Transfer", 4th ed., S.Chand & Co, New Delhi, 2008.
2. Artur V.Kilian, "Solar Collectors: Energy Conservation, Design and Applications", Nova Science Publishers Incorporated, 2009.
3. Soteris A.Kalogiru, "Solar Energy Engineering: Processes and systems", 1st edition, Academic press, 2009.
4. Duffie .J. A & Beckman .W.A, "Solar Engineering of Thermal Processes", 3rd edition, John Wiley & Sons, Inc., 2006.
5. Garg .H.P,Prakash.J, "Solar energy fundamentals and applications", Tata McGraw Hill publishing Co. Ltd, 2006.



Source: https://www.nature.com/articles/s41598-020-77442-y

22EE855 - FUNDAMENTALS OF ELECTRIC VEHICLES

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basic Electrical & Electronics Engineering; Electrical Machines; Power Electronics

COURSE DESCRIPTION AND OBJECTIVES:

To make students understand the need and importance of Electric, Hybrid Electric Vehicles and Fuel cell vehicle. To differentiate and analyze the various energy storage devices and battery charging and management systems. To impart knowledge about architecture and performance of Electric and Hybrid Vehicles. To classify the different drives and controls used in electric vehicles.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

EV FUNDAMENTALS AND POWER ELECTRONICS IN EVS:

EV Fundamentals: Vehicle Basics, vehicle model, Vehicle Resistance: Rolling Resistance, Aerodynamic Drag, Grading Resistance, Dynamic Equation Tire–Ground Adhesion and Maximum Tractive Effort, Power Train Tractive Effort and Vehicle Speed, EV Powertrain Component Sizing.
Power Electronics in EVs: Power electronics circuits used for control and distribution of electric power in DC-DC, AC-DC, DC-AC converters used for EV.

UNIT-2 **8L+8T+0P=16 Hours**

ELECTRIC MACHINES AND DRIVES IN HEVS:

Fundamental of Drives and Control of EV Using DC motor, Induction Motor, Permanent Magnet Motor, Switched Reluctance Motor, BLDC motor, Design and Sizing of Traction Motors.

PRACTICES:

- Develop a simulation model for Electric Vehicle to analyze the effect of changing of parameters on vehicle range and performance.
- Develop a simulation model for different driving cycles and analyze these driving cycles.
- DC-DC non isolated converters (Buck, boost) (MATLAB Simulation & Hardware).

MODULE –2

UNIT-1 **8L+8T+0P=16 Hours**

BATTERIES, ULTRA CAPACITOR, FUEL CELLS, AND CONTROLS:

Introduction, Different batteries for EV, Battery Characterization, Comparison of Different Energy Storage Technologies for EVs, Battery Charging Control, Charge Management of Storage Devices.

UNIT-2 **8L+8T+0P=16 Hours**

EV CHARGING TECHNOLOGIES:

Classification of different charging technology for EV charging station, introduction to Grid-to-Vehicle, Vehicle to Grid (V2G) or Vehicle to Buildings (V2B) or Vehicle to Home (V2H) operations, bi-directional EV charging systems.

PRACTICES:

- Study of Charging and discharging characteristics
- Comparative Study of Lead acid and Li-ion battery
- Power train Sizing Calculation Procedure and Practice Problems

SKILLS:

- Suggest suitable converter for speed control of Electric Vehicle.
- Auxiliary DC-DC converters
- Powertrain Sizing Calculation Procedure and Practice Problems
- Lithium Batteries and Battery Pack Design for Electric & Hybrid Vehicle Application

COURSE OUTCOMES:

Upon successful completion of this course, students will have to ability to:

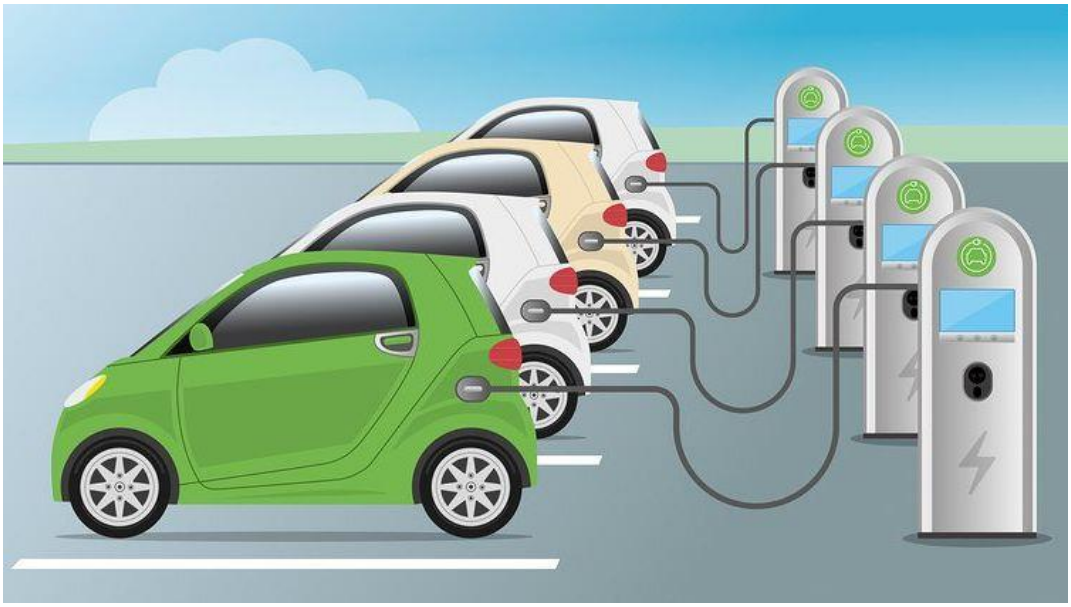
CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Explain the basics of electric vehicles, their architecture, technologies and fundamentals.	Apply	1	1, 2, 3, 4, 7
2	Analyze the use of different power electronics converters and electrical machines in electric vehicles.	Analyse	1	1, 2, 3, 4, 5, 6
3	Explain the use of different energy storage systems used for electric vehicles, their control techniques, and select appropriate energy balancing technology	Analyse	2	1, 5, 7, 9
4	Interpret the working of different configurations of electric vehicles and its components, hybrid vehicle configurations	Create	2	1, 5, 7, 9

TEXT BOOKS:

1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
2. Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017

REFERENCE BOOKS:

1. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
2. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Mehrdad EhsaniYimin Gao Stefano Longo Kambiz M. Ebrahimi, Taylor & Francis Group, LLC, 2018.



Source: https://studyelectrical.com/course/fundamentals-of-electric-vehicles-technology-economics

22FT851 – HUMAN NUTRITION

Hours per Week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Nutrition, Food, Chemistry, Biology.

COURSE DESCRIPTION AND OBJECTIVES:

This course offers the student's knowledge on biological basis of nutrition, metabolic pathways and mechanisms by which diet can influence health. The objective of this course is to empower the students with methods and techniques for making nutrient profiles for balanced diet and health.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

BASICS OF HUMAN NUTRITION:

Introduction to human nutrition; Nutrients- Classification, functions, properties (physical, chemical and structural) and sources of carbohydrate, protein, lipids, vitamins and minerals; Deficiency disorders of nutrients.

UNIT-2 **10L+10T+0P=20 Hours**

ANALYSIS OF NUTRIENTS:

Analysis of nutrients- carbohydrate, protein, lipids, fibers, vitamins, minerals, amino acids, fatty acids; Evaluation of protein quality.

PRACTICES:

- Determination of moisture content
- Determination of ash content
- Determination of protein by kjeldhal method
- Determination of fat by Soxhlet method.
- Determination of crude fiber content
- Determination of reducing and non-reducing sugars.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

ENERGY REQUIREMENT:

Composition of human adult body, techniques for the measurement of body composition, primary influences on body composition (nutrition, physical activity, hormones, trauma and disease). Energy balance- Components of energy intake and expenditure; Control of food intake and regulation of energy balance- internal and external factors; Assessment of energy expenditure at rest and work-calorimetry and computation of energy requirements.

UNIT-2 **8L+8T+0P=16 Hours**

PROCESSING OF BIOMOLECULES:

Formulation of diet, Basal Metabolic Rate (BMR), assessment of nutritional status, RDA for nutrients for various group.

PRACTICES:

- Determination of pulse rate in Resting condition and after exercise (30 beats/10 beats method)
- Determination of blood pressure by Sphygmomanometer (Auscultatory method)
- Calculation of Basal Metabolic Rate (BMR)
- Preparation of diet chart

SKILLS:

- Analyze the nutrient requirements.
- Assess the nutritional status of different group of people
- Apply standards practices in food testing laboratory
- Analyze the energy requirement for various works
- Design the desired diet as per requirement of specific groups

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Identify and analyse the basic nutrients in food samples	Apply	1	1, 2, 4, 5,6,7, 12
2	Investigate the mechanism of carbohydrate, protein and lipids in cellular system	Apply	2	1, 2, 3, 4, 5, 6,7, 8,12
3	Analyse properties and importance of nutrients	Analyze	1, 2	1, 2, 3, 4, 6, 7, 8, 9
4	Identify and design the nutritional diet to ensure nutritional security for healthy, diseased, sports personnel, pregnant women and elderly person	Evaluate	1, 2	1, 2, 3, 4, 5, 6, 8, 9, 11, 12
5	Create the nutrient and diet requirements for a child, young person, pregnant women and old person	Create	1	1, 2, 5, 9, 10, 12

TEXT BOOKS:

1. Chattopadhyay Ghosh S and Base N. UcchaMadhaymikKhadda O Pusti, Calcutta Book House, 2015
2. Srilakshmi B. Nutrition Science. New Delhi: New Age International, 2018

REFERENCE BOOKS:

1. J. L. Jain, Sunjay Jain and Nitin Jain "Fundamentals of Biochemistry", 6th edition, S Chand and Co. Ltd, Ram Nagar, New Delhi, 2005.
2. Tom Brody "Nutritional Biochemistry", 2nd Edition, Academic Press. 1998.
3. Joshi SA., Nutrition and Dietetics. 3rd Ed. New Delhi: McGraw Hill Education (India) Put Ltd, 2010

Image File Name: Human Nutrition

Image Source: https://www.openpr.com/news/1969306/human-nutrition-market-2020-soaring-demand-assures-motivated

22FT852 – TRADITIONAL FOODS

Hours per Week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basics of technology involved in carbonated, non-carbonated and fermented beverages preparation

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with diverse foods, food habits and food patterns in India with focus on traditional foods.

MODULE-1

UNIT-1 **12L+0T+2P=14Hours**

INTRODUCTION TO TRADITIONAL FOOD PATTERNS:

Introduction: Typical breakfast, meal and snack foods of different regions of India. Regional foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods, pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods

UNIT-2 **4L+0T+14P=18 Hours**

TRADITIONAL METHODS OF FOOD PROCESSING:

Traditional methods of milling grains – rice, wheat and corn – equipment's and processes as compared to modern methods. Equipment's and processes for edible oil extraction, paneer, butter and ghee manufacture – comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation – sun drying, osmotic drying, brining, pickling and smoking.

PRACTICES

- Study the difference between sun drying and tray drying of fishes
- Cold press oil and industrial solvent extraction
- Study transport phenomena of moisture and fat in *Gulabjamun.*
- Microbial quality study of traditional pickles

MODULE-2

UNIT-1 **12L+0T+4P=16 Hours**

TRADITIONAL FOOD PATTERNS AND HEALTH ASPECTS OF TRADIONAL FOODS:

Typical breakfast, meal and snack foods of different regions of India. Regional foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods, pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods. Comparison of traditional foods with typical fast foods / junk foods – cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments /illnesses.

UNIT-2 **4L+12T+0P=16 Hours**

COMMERCIAL PRODUCTION OF TRADITIONAL FOODS:

Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods – types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods – ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters.

PRACTICES:

- Preparation of *idly*
- Development of *Ambali*
- To study of quality parameters of *Ragi huri hittu*
- Cost analysis of *Enduri pitta*
- To study processing parameters of *Selroti*

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the traditional perspective of foods and food habits to modern food habits	Apply	1	1, 2, 3, 4
2	Gain knowledge about of the wide diversity and common features of traditional Indian foods and meal patterns.	Apply	1	1, 2, 3, 5
3	Analyse the physico-chemical properties of different categories of traditional foods	Analyse	2	1, 2, 4, 5
4	Study the techniques involved in the production of traditional foods	Analyse	2	1, 3, 4

TEXT BOOKS:

1. Sen, Colleen Taylor Food Culture in India Greenwood Press, 2005.
2. Davidar, Ruth N. Indian Food Science: A Health and Nutrition Guide to Traditional Recipes: East West Books, 2001.

REFERENCE BOOKS:

1. Mohammed Al-Khusaibi. Traditional Foods: History, Preparation, Processing and Safety (Food Engineering Series) 1st ed. 2019 Edition
2. Charis M. Galanakis. Innovations in Traditional Foods. 978-0-12-814887-7. Woodhead Publishing. 2019

Image File Name: Indian Traditional Food

Image Source: https://drishtidarshan.com/12-traditional-south-indian-food/

22IT851 - MOBILE APPLICATION DEVELOPMENT

Hours per Week:

L	T	P	C
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basics of object oriented programming through JAVA, XML.

COURSE DESCRIPTION AND OBJECTIVES:

This course helps a student to design effective mobile applications using the Android development environment. The main objective of this course is to create user-friendly applications that involve design of layout, window components, and multiple screens with one- touch options.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

GETTING STARTED WITH ANDROID PROGRAMMING AND ACTIVITIES:

Introduction To Android: Android introduction, Versions of android, Features of android, Architecture, Devices in the market, Developer community.

Understanding Activities: Life cycle of an activity, applying styles and themes, Types of dialog boxes, Types of Intents, Resolving Intent filter collision, Returning Results from an Intent, passing the data using Intent Object.

UNIT-2 **8L+8T+0P=16 Hours**

INTENTS AND FRAGMENTS:

Intents: understanding about Intent Objet and Intent filters, calling built in apps using Intents.

Fragments: Fragment types, Life Cycle, Interaction between Fragments.

PRACTICES:

- Installation of Android studio, its required tools and AVD.
- Displaying the hello world message in AVD.
- Creating a basic activity and applying themes, styles to it.
- Displaying various types of Dialog objects.
- Linking activities with Intents.
- Passing data using intent object.
- Usage of Fragments and adding them dynamically to the application.
- Communication between fragments.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

ANDROID UI DESIGN & DISPLAY ORIENTATION:

Android UI Design: Understand components of a screen, View, View Groups, Linear Layout, Absolute Layout, Table Layout, Relative Layout, Frame Layout, Scroll View.

Display Orientation: Anchoring Views, Resizing and Repositioning Views, managing changes to screen orientation, utilizing the action bar, Creating UI programmatically.

UNIT-2 **8L+8T+0P=16 Hours**

UNDERSTANDING BASIC VIEWS:

Basic Views: Designing UI with basic views, Progress bar view, Auto complete Text View.

PRACTICES:

- Design an application with various Layouts.
- Designing Action bar to the application.
- Handling the basic view events of the application.
- Design an application to implement AutoComplete Text View.

SKILLS:

- Understanding mobile applications for user requirements.
- Usage of various components of Android operating system.
- Utilization of activities, intents, layouts and views for content.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the android mobile application design models and styles to mobile apps.	Apply	1	1,2,3,9,10,12
2	Apply activities, dialog boxes, fragments, intents, views and layouts to android apps	Apply	1, 2	1,2,3,4,9,10,12
3	Analyze various mobile applications during the design of mobile apps.	Analyze	1, 2	1,2,3,5,9,10,12
4	Create user-friendly mobile user interfaces and views.	Create	2	1,2,3,4,5,9,10, 12
5	Design and develop mobile apps for given real time scenario using modern tool android studio.	Create	1, 2	1,2,3,4,5,9,10, 12

TEXT BOOK:

1. Wei-Meng Lee, "Beginning Android 4 Application Development", 1st Edition, John Wiley & Sons, 2012.
2. RaimonRefolsMontane, Laurence Dawson, "Learning and Android Application Development", 1st Edition, PACKT Publishing, 2016.

REFERENCE BOOKS:

1. Reto Meier, "Professional Android 4 Application Development", 3rd Edition, Wrox, 2012.
2. Adam Gerber and Clifton Craig, "Learn Android Studio", 1st Edition, Apress, 2015.

Image source: https://5.imimg.com/data5/FH/UC/MY-9120378/android-app-development-company-500x500.png

Image file name:

22IT852 - OBJECT ORIENTED PROGRAMMING

Hours per Week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Computer programming

COURSE DESCRIPTION AND OBJECTIVES:

This course is about the fundamentals of Object-Oriented Programming (OOP) Concept and OOP-based software development methodology. Java as a class-based and pure OOP language is used to demonstrate and implement appropriate concepts and techniques. The students are exposed to the concepts, fundamental syntax, and the thought processes behind object oriented programming. By end of the course, students will acquire the basic knowledge and skills necessary to implement object-oriented programming techniques in software development using Java.

MODULE-1

UNIT-1 **10L+6T+0P=16 Hours**

BUILDING BLOCKS OF OOPS:

Introduction: Java buzzwords, OOP principles, Data types, Operators, Control statements, Type conversion and casting, Arrays.

Classes and Methods: Introduction to classes and methods, objects, Constructors, Usage of static, Access control, String class, String Tokenizer.

Inheritance: Basics of Inheritance, Types of inheritance, Abstract classes, Interfaces, Usage of final, creating, defining and accessing Packages

UNIT-2 **6L+10T+0P=16 Hours**

OVERLOADING, INTERFACES AND PACKAGES:

Overloading: Overloading Methods and Constructors, this key word, Usage of super key word, Polymorphism, Method overriding

Interfaces: implementing interface, extending interfaces, accessing a package, importing packages.

PRACTICES:

- Reading different types of data from the user and display that data using Scanner class.
- Illustrating type conversions.
- Implementing different operators.
- Generating electricity bill
- Implementing different patterns.
- Implementing logical programs.
- Implementing Arrays.
- Implementing String class.
- Implementing String Tokenizer class.
- Implementing super keyword.
- Implementing forms of Inheritance
- Implementing overloading and overriding.
- Implementing runtime polymorphism.

- Create an abstract class Media (id, description). Derive classes Book (page count) and CD (play time). Define parameterized constructors. Create one object of Book and CD each and display the details.
- Define an interface, operations which has method area (), volume (). Define a constant PI having value 3.14. Create class a Cylinder which implements this interface (member-id, height). Create one object and calculate area and volume.
- Implementing packages.

MODULE-2

UNIT-1 **10L+6T+0P=16 Hours**

EXCEPTION HANDLING AND MULTITHREADING:

Exception Handling: Concepts of exception handling, Types of exceptions, Built-in exceptions, Usage of try, catch, throw, throws and finally keywords.

Multithreading: Concepts of Thread, Thread priorities, multithreading, Daemon thread, Synchronization.

UNIT-2 **6L+10T+0P=16 Hours**

AWT, APPLETS AND GUI PROGRAMMING WITH SWING:

AWT and Applets: Concepts of applets, differences between applets and applications, life cycle of applet, AWT, AWT Hierarchy, AWT Controls.

Exploring Swing Controls: JLabel JText Field, JButton, JCheckBox, JRadioButton, JTabbed Pane, JList, JCombo Box.

PRACTICES:

- Implementing Exception handling.
- Implement java program which accepts withdraw amount from the user and throws an exception "In Sufficient Funds" when withdraw amount more than available amount.
- Creating Thread.
- Implementing multithreading.
- Create three threads and that displays "good morning", for every one second ,"hello" for every 2 seconds and "welcome" for every 3 seconds by using extending Thread class.
- Creating simple Applet.
- Develop an Applet program to accept two numbers from user and output the sum, difference in the respective text boxes**.**
- Implementing JLabel and JText Field.
- Implementing JButton and JRadioButton.
- Design student registration form using Swing Controls. The form which having the following fields and button SAVE a. Form Fields are: Name, RNO, Mailid, Gender, Branch, Address**.**

SKILLS:

- Analyze and develop algorithm for real life problems using Java.
- Able to develop multi-threaded applications.
- Able to create efficient software applications.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Familiar with Object oriented concepts and JVM	Apply	1	1,2,3,4,5,9,10, 12
2	Apply inheritance and polymorphism	Apply	1	1,2,3,4,5,9,10, 12
3	Apply packages and interfaces to develop real time applications	Apply	1	1,2,3,4,5,9,10, 12
4	Develop Interfaces and Packages.	Analyze	2	1,2,3,4,5,9,10, 12
5	Design and develop GUI based applications using applets and swings for internet and system based applications.	Create	2	1,2,3,4,5,9,10, 12

TEXT BOOKS:

1. Herbert Scheldt, "Java the complete reference", 12th Edition, McGraw Hill, Education, 2021.
2. T. Budd, "Understanding Object-Oriented Programming with Java", Updated Edition, Pearson Education, 2000.

REFERENCE BOOKS:

1. J. Nino and F.A. Hosch, "An Introduction to programming and OO design using Java", 3rd Edition, John Wiley & sons, 2008.
2. P. Radha Krishna, "Object Oriented Programming through Java", 1st Edition, Universities Press, 2007.
3. R. A. Johnson, "Java Programming and Object Oriented Application Development", 1st Edition, Cengage Learning, 2006.

Course Image:

Source of Image: https://www.datasciencecentral.com/what-should-java-developers-learn-in-2021/

22IT853 - OPEN SOURCE WEB TECHNOLOGIES

Hours per Week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: HTML, CSS and JavaScript

COURSE DESCRIPTION AND OBJECTIVES: This course introduces the concepts pertaining to open-source technologies such as LINUX, MySQL, PHP, Apache web server, and various other tools used to develop web applications. In addition, this course is to offer insight into various open-source technologies to develop web applications.

MODULE-1

UNIT-1 **8L+8T+0P=16Hours**

OPEN SOURCE:

Open Source: Introduction, Open source operating System, Nature of open sources, Advantages, Application of open sources. Introduction to dynamic web content, Setting up a development server, Introduction to PHP, PHP functions and Objects, PHP arrays, Practical PHP.

UNIT-2 **8L+8T+0P=16Hours**

OPEN SOURCE DATABASE:

Open Source Database: Introduction to MySQL, Accessing MySQL using PHP, querying a MySQL database with PHP, Practical MySQL, preventing hacking attempts, Using MySQL procedure.

Form Handling: Form Handling building forms, Retrieving submitted data, An example program, Cookies, Sessions, and authentication using cookies in PHP, HTTP authentication, Using sessions.

PRACTICES:

- Develop dynamic web content pages.
- Setting up a development server.
- Practice Basic PHP programs.
- Working with PHP functions and Objects.
- Create arrays using PHP.
- Create dynamic web pages using PHP.
- Practice basic MySQL queries.
- Access MySQL database using PHP.
- Create Database Connectivity with PHP & MySQL.
- Working with MySQL procedures.
- Create forms using PHP and retrieve the data from the database.
- Work with Cookies and Sessions in PHP.

MODULE-2

UNIT-1 **8L+8T+0P=16Hours**

HTML5:

Introduction: to HTML5, The HTML5 Canvas, HTML5 audio, and video, Bringing it all together by designing a social networking site.

UNIT-2 **8L+8T+0P=16Hours**

ANGULAR JS:

Angular JS: The basics of AngularJS, Introduction MVC, Filters, and modules, Directives, Working with Forms, Services and server communication, Organizing views, Angular JS animation.

PRACTICES:

- Practice basic HTML5 tags.
- Usage of HTML5 audio, video, and canvas tags.
- Build a Social Networking Website.
- Practice basic AngularJS.
- Working with forms, services, and server communication through AngularJS.
- Using views in AngularJS applications.
- Create animations using AngularJS.

SKILLS:

- Use the Open source technologies.
- Develop dynamic web pages.
- Design a social networking website.
- Apply the AngularJS concepts to dynamic websites.
- Create animations using AngularJS.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Make use of open source technologies.	Apply	1	1, 2, 3, 9, 10, 12
2	Familiar with HTML5 tags and AngularJS.	Apply	1	1, 2, 3, 9, 10, 12
3	Create dynamic web pages using PHP & MySQL	Create	1	1, 2, 3, 4, 9, 10, 12
4	Design a social networking website using open-source technologies.	Create	2	1, 3, 4, 5, 9, 10, 12
5	Design and develop dynamic websites with animations using AngularJS.	Create	2	1, 2, 3, 4, 5, 9, 10, 12

TEXT BOOKS:

1. Robin Nixon, “Learning PHP, MySQL & JavaScript WITH JQUERY, CSS & HTML5”, 5th Edition, O’Reilly, 2018.
2. Andrew Grant, “Beginning Angular JS”, 1st Edition, Apress, 2014.

REFERENCE BOOKS:

1. Steve Prettyman, “Learn PHP 7 Object Oriented Modular Programming using HTML5, CSS3, JavaScript, XML, JSON, and MySQL”, 1st Edition, Apress, 2015.
2. Adrian W. West and Steve Prettyman, “Practical PHP 7, MySQL 8, and MariaDB Website Databases: A Simplified Approach to Developing Database-Driven Websites”, 2nd Edition, A Press, 2018.

Image Source:

https://thumbs.dreamstime.com/z/painted-hand-shows-concept-hologram-open-source-his-hand-painted-hand-shows-concept-hologram-open-source-his-hand-drawn-man-115398454.jpg

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22IT854 - PYTHON PROGRAMMING

Hours per Week:

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Computer programming

COURSE DESCRIPTION AND OBJECTIVES:

This course offers sufficient knowledge required to understand the fundamental concepts of Python programming language. This course enables students to choose appropriate data structures like lists, dictionaries, tuples, sets, strings for the given problem. In addition, the students will be able to create reliable, modular and reusable applications using Object- Oriented Programming approaches.

MODULE-1

UNIT-1 **8L+6T+0P=14 Hours**

PYTHON BASICS:

Python Installation and Working of it, get familiar with python variables and data types, Operator understanding and its usage, detail study of python blocks, Hands on with conditional blocks using if, else and elif

UNIT-2 **8L+10T+0P=18 Hours**

WORKING WITH VARIETIES OF DATA:

Hands on string handling and looping with range, list, Tuples, Sets and dictionaries. hands on to organize python code with function, modular approach in python.

PRACTICES:

- Installation of python and relevant packages in windows.
- Installation of python and relevant packages in Linux.
- Practice Execution of python statements in REPL(shell).
- Implement a python program to display all the python keywords and display each of them in separate lines.
- Develop a python program to read two integers and perform all possible arithmetic operations on those two numbers.
- Develop a program to accept three numbers as command line arguments and find biggest, smallest and average of those three numbers.
- Implement a python program to find first n Prime Numbers.
- Implement a program that prints the decimal equivalents of 1/2, 1/3, 1/4, . . . ,1/n.
- Implement a python program to read n and find sum of even and odd numbers.
- Write python code to achieve the following
  - to remove vowels in the given string using control transfer statements.
  - to count number of uppercase and lowercase letters in the given string.
  - to remove all punctuation characters from given string.
- Implement python code to illustrate the following on Lists and Tuples
  a) Creation b) Accessing elements c) apply operators d) Usage of different methods
- Implement python code to illustrate the following on Sets and Dictionary
  a) Creation b) Accessing elements c) apply operators d) Usage of different methods

- Implement python code to illustrate the following
  i) Positional arguments ii) Keyword arguments iii) Default arguments iv) Variable length arguments
- Implement a function to find nth Fibonacci number.
- Develop a recursive function to find the factorial of a given number.
- Implement function to compute GCD, LCM of two numbers (use Lambda function).

MODULE-2

UNIT-1 **8L+0T+8P=16 Hours**

EXCEPTION AND FILE HANDLING:

Handling and helping file operations, coding with the exceptional handling

UNIT-2 **8L+0T+8P=16 Hours**

OBJECT ORIENTED PROGRAMMING:

Object-Oriented Programming, Classes and working with instances, Method overloading, Polymorphism

PRACTICES:

- Develop a python code to handle the following built-in exceptions
  i) ValueError ii) ZeroDivisionError iii) TypeError iv) NameErrror
- Implement python code to handle multiple exceptions.
- Implement Python code to raise an exception.
- Implement python code to read contents of a file and write the contents to another file.
- Create a class called Student and perform operations such as display, Calculate percentage, add, delete and modify student data.
- Design python code to depict the following oops concepts: i) Datahiding ii) Inheritance iii) Overriding
- Develop python code to calculate the following statistical parameters using python ‘numpy’.
- Mean b) Hormonic Mean c) Meadian d) Mode e) Standard Deviation f) Variance g) Percentile
- Design python code to illustrate the following plots using ‘matplotlib’ package
- Line plot b) Bar plot c) Histogram d) Scatter Plot
- Implement python program for the following problems on Pandas DataFrame
- Write a Pandas program to create and display a DataFrame from a specified dictionary data which has the index labels. Sample Python dictionary data and list labels:
- exam_data = {‘name’: [‘Anastasia’, ‘Dima’, ‘Katherine’, ‘James’, ‘Emily’, ‘Michael’, ‘Matthew’, ‘Laura’, ‘Kevin’, ‘Jonas’], ‘score’: [12.5, 9, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19], ‘attempts’: [1, 3, 2, 3, 2, 3, 1, 1, 2, 1], ‘qualify’: [‘yes’, ‘no’, ‘yes’, ‘no’, ‘no’, ‘yes’, ‘yes’, ‘no’, ‘no’, ‘yes’]} labels = [‘a’, ‘b’, ‘c’, ‘d’, ‘e’, ‘f’, ‘g’, ‘h’, ‘i’, ‘j’]
- Write a Pandas program to select the ‘name’ and ‘score’ columns from the following DataFrame.
- Write a Pandas program to select the specified columns and rows from a given data frame.
- Write a Pandas program to select the rows where the number of attempts in the examination is greater than 2.

- Write a Pandas program to count the number of rows and columns of a DataFrame.
- Write a Pandas program to change the name 'James' to 'Adhvik' in name column of the DataFrame.

SKILLS:

- Identify suitable data types and data structures required for an application
- Design structured and Object oriented programming solutions
- Design reliable applications for a given problem.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Experiment with the basic terminology used in computer programming to write, compile and debug programs in python language.	Apply	1	1,2,3,9,10,12
2	Make use of different data types to design programs involving decisions, loops, and functions.	Apply	1	1,2,3,9,10,12
3	Apply functional, reliable and user-friendly python programs for a given problem application.	Apply	1	1,2,3,9,10,12
4	Develop solutions using the concepts of object oriented programming paradigm.	Apply	2	1,2,3,9,10,12
5	Analyze the usage of different data structures for practical and contemporary applications which uses data stored in files.	Analyze	1,2	1,2,3,4,5,9,10,12

TEXT BOOK:

1. Reema Thareja, "Python Programming: Using Problem Solving Approach", 1st Edition, Oxford University Press, 2017.
2. Eric Matthes, "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.

REFERENCE BOOKS:

1. John V. Guttag, "Introduction to Computation and Programming Using Python", 3rd Edition, The MIT Press, 2021
2. Allen B. Downey," Think Python", 2nd edition, O'rielly publishing, 2015.
3. Vamsi Kurama, "Python Programming: A Modern Approach", 1st Edition, Pearson Publishers, 2018.

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Image source: https://webnotics.solutions/python-programming/

22IT855 - WEB TECHNOLOGIES

Hours per Week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Computer programming

COURSE DESCRIPTION AND OBJECTIVES:

This course offers the basic concepts used to develop static web pages and it also provides knowledge of Internet programming concepts. Further, this course is to build web applications using HTML, CSS, and client side script technologies that span multiple domains.

MODULE-1

UNIT-1 **10L+6T+0P=16Hours**

HTML BASICS:

Coding Basics: HTML Syntax, html, head, title, and body tags, Headings, paragraphs and lists, The strong and em tags, The doctype, The lang attribute, The meta tag, and the Unicode character set.

Coding Links: Absolute & Relative URLs; Anchor tags and hrefs, Linking to other websites, Linking to pages within a website, Opening a link in a new browser window/tab.

Adding Images: The break tag, The image tag, and source attribute, Using the width, height, and alt attributes, Using horizontal rules, tables, forms, and frames.

UNIT-2 **6L+10T+0P=16 Hours**

CASCADING STYLE SHEETS & DIV TAGS:

Cascading Style Sheets (CSS): The style tag, Tag selectors, font size, font family, color, & line-height properties, and Hexadecimal color codes.

CSS Properties: Text, background, border, list and font.

CSS Class Selectors: The class attribute, CSS class selectors, The span tag, CSS opacity.

Div Tags, ID Selectors, & Basic Page Formatting: Dividing up content with the div tag, Assigning IDs to divs, Setting width & max-width, CSS background color, Adding padding inside a div, Centering content, CSS borders, CSS shorthand & the DRY principle.

PRACTICES:

- Practice Basic HTML tags
- Create links on same page and other pages
- Insert images on a web page
- Create lists on a web page
- Create Tables on a web page
- Create forms such as login form and registration form etc.
- Working with Frames
- Add different types of CSS to web pages
- Usage of div tag in the web page
- Create a personal website using HTML and CSS.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

JAVA SCRIPT:

Java Script: Introduction, Document Object Model, Language Syntax, Variable declaration, Operators, Control Statements, Understanding Arrays, Function Declaration.

Built-in Functions: Standard Date and Time, String, Array and Math.

UNIT-2 **8L+8T+0P=16 Hours**

HTML FORM VALIDATIONS:

HTML Form Validations: HTML Document Object Model, Working with HTML form and its elements.

Working with Objects and Classes: Working with Objects, Call method in JavaScript, Inheritance in JavaScript using prototype.

Java script Events: Keyboard events, mouse events, form events.

PRACTICES:

- Practice basic JavaScript programs such as the variable declaration and operators.
- Usage of Control Statements in JavaScript.
- Creating and accessing arrays in JavaScript.
- Working with functions in JavaScript.
- Perform validations on HTML forms using JavaScript.
- Working with Cookies.
- Create JavaScript Objects and Classes.
- Apply JavaScript on HTML and CSS webpages.

SKILLS:

- Apply the CSS and JavaScript on HTML web pages.
- Develop static web pages.
- Create dynamic websites.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Familiar with HTML Tags	Apply	1	1, 2, 3, 9, 10, 12
2	Apply the tags and create static web pages using forms	Apply	1	1, 2, 3, 9, 10, 12
3	Apply Cascading Style Sheets and Div Tags to HTML static webpages	Apply	1	1, 2, 3,4,9,10,12
4	Familiar with JavaScript functions and form validations.	Analyze	2	1, 2, 3,4, 5, 9, 10, 12
5	Design and develop dynamic websites	Create	2	1, 2, 3,4, 5, 9, 10, 12

TEXT BOOKS:

1. Jon Duckett, “Beginning Web Programming with HTML, XHTML, and CSS”, 2nd Edition, Wiley India Pvt. Ltd, 2008.
2. Julie C. Meloni , “HTML, CSS, and JavaScript All in One”, Sams Teach Yourself, 3rd Edition, Pearson, 2015.

REFERENCE BOOKS:

1. Chris Bates, “Web Programming, Building Internet Applications”, 3rd Edition, Wiley Dream Tech, 2006.
2. Jon Duckett, “HTML & CSS: Design and Build Websites”, 1st Edition, John Wiley & Sons, 2011.
3. Uttam K Roy, “Web Technologies”, 2nd Edition, Oxford University Press, 2010.
4. Laura Lemay, Rafe Colburn, Jennifer Kyrnin, “Mastering Html, CSS & JavaScript Web Publishing”, 7th edition, BPB Publications, 2015.

Image Source: https://honestproscons.com/wp-content/uploads/2021/03/web-technology.jpg

Image:

22MS851- MARKETING AND HUMAN RESOURCE MANAGEMENT

Hours per week:

L	T	P	C
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basic knowledge on marketing and human resource management.

COURSE DESCRIPTION AND OBJECTIVES: By the end of this course it is expected that the student will be able to Understand concepts of marketing and Indian marketing environment, Importance of segmentation, targeting and positioning in marketing planning, Importance of Marketing mix elements in attracting customers to buy, Nature, scope, importance and functions of HRM and Job analysis, performance evaluation, wage and salary administration.

MODULE-1

UNIT-1 **6L+9T+0P=15 Hours**

Introduction to Marketing: Needs, Wants, Demands, Products, Exchange, Transactions, Market, Marketing, Production Concept, Product Concept, Sales Concept, Marketing Concept, Societal Marketing Concept, Marketing Environment, Indian Marketing Environment

UNIT-2 **4L+11T+0P=15 Hours**

Identification of Market Segments: Consumer and Institutional / Corporate Clientele – Segmenting Consumer Markets, Segmentation Basis, Selecting Target Markets, Segmentation and Targeting as a Basis for Strategy Formulation, Developing and Communicating a Positioning Strategy.

PRACTICES:

- To analyze the concepts of marketing in Indian environment
- To apply the marketing mix in various situations
- To know about STP in marketing

MODULE-2

UNIT-1 **4L+11T+0P=15 Hours**

MARKETING MIX ELEMENTS:

Product Management: Product Life Cycle, Product Line, Product Mix, Product-line decisions, Brand decisions, classification of new products, New Product Development

Pricing Strategy: Objectives of Pricing, Methods of Pricing. Sales And distribution Management

Marketing Communication: The communication process, Communication mix, Managing advertising, sales promotion, Public relations and Direct Marketing

UNIT-2 **6L+9T+0P=15 Hours**

Human Resource Management and development process: Introduction: Definition, Nature – Scope – Objective – Importance – Functions of HRM – Challenges of HRM, Human Resource Planning Process – Corporate social responsibility Basic prerequisites – Job Analysis, Job

Description – Job Specification and evaluation – Job Design – Training Methods – Performance Appraisal – Objectives – Methods – Wage and Salary Administration

PRACTICES:

- To know about the product life cycle and product mix
- To evaluate the pricing strategies and S&D
- To maintain the public relations and csr duties

SKILLS:

- To be an expert in marketing area
- Analyze the job description and to maintain performance appraisal
- To evaluate the challenges in MHRM areas

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Outline the various properties and **Apply** marketing areas.	Apply	1	1, 2,
2	**Identify** the pricing strategies	Apply	1, 2	1, 2, 3
3	**Analyse** the new product development	Analyze	1, 2	1, 2,
4	**Inspect** STP process	Analyze	2	1, 2,
5	**Evaluate** the marketing areas, job analysis, job description, performance appraisal	Evaluate	1, 2	1, 2, 3,

TEXT BOOKS:

1. Rajan Saxena, "Marketing Management", 2nd ed., TMH, 2006.
2. V.S.Ramaswamy , S.Namakumari, "Marketing Management", 3rd ed., Macmillan, 2003.

REFERENCE BOOKS:

1. Phillip Kotler, "Maketing Management", 11th ed, Pearson Publishers, 2007.
2. Philip Kotler and Kelvin Lane, "Marketing Mangement", 12th ed., Pearson Education, 2007.
3. Mirza S. Saiyadain – "Human Resource Management", 5th ed., Tata McGraw-Hill, 2001.

IMAGE SOURCE:

https://www.google.co.in/url?sa=i&url=https%3A%2F%2Fdiferr.com%2Fdifference-between-human-resource-management-and-marketing-

22MS852- ORGANISATIONAL BEHAVIOUR

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basic knowledge on psychology.

COURSE DESCRIPTION AND OBJECTIVES: By the end of the course the learners will be able to Understand nature and scope of OB, Become aware of perceptual process and possible errors, Identify differences in personalities and attitudes, Act according to the group dynamics and handle stress and Resolve certain issues by applying conflict management.

MODULE-1

UNIT-1 **6L+9T+0P=15 Hours**

INTRODUCTION TO OB:

Nature of OB: Nature and scope of OB - contributing disciplines to OB - Environmental and Organizational context of Organizational Behavior.

UNIT-2 **4L+11T+0P=15 Hours**

PERCEPTION, PERSONALITY AND ATTITUDE:

Perception - Process: Individual and Organizational factors that influence perceptual process. Role of perception in managerial activities and organizational processes.

Personality and Attitudes: Personality as continuum – Meaning of Personality – Johari window and Transactional Analysis Nature and Dimension of Attitudes.

PRACTICES:

- To apply the disciplines of OB
- To analyze the organizational factors and managerial activities.
- To evaluate the managerial activities.

MODULE-2

UNIT-1 **6L+9T+0P=15 Hours**

Group Dynamics: The Nature of groups. Kinds of groups – Stages of Group Development – Factors Contributing to Groups Cohesiveness - Meaning & types of stress – Effect of Stress – Strategies of cope with stress Principles of Learning & Reinforcement - Observational Learning - Cognitive Learning - Organizational Behaviour Modification - Steps in Organizational Behaviour Modification process.

UNIT-2 **4L+11T+0P=15 Hours**

Conflict Management: Nature of conflict – Dynamics of Conflict – Conflict resolution modes – approaches to conflict management – sources of conflict in organization.

PRACTICES:

- Survey on resistance to changing policies in The Banking Sector, The IT Sector.
- Undertake a study to find out the various non-financial incentives used to motivate employees.

- A study in job enrichment and factors contributing to absenteeism and employee turnover in any industry of your choice.
- Analyze the characteristics and components of attitudes.
- Perform a study on the determinants of personality of a group of individuals.
- Analyze the organizational culture and climate in the BPO industry.
- Conduct a study on the reasons for attrition in the BPO industry.

SKILLS:

- To be an expert in personality design.
- To know how to solve the conflicts.
- To be an expert in organisational modification process.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Outline the various properties and **Apply organisational behaviour.**.	Apply	1	1, 2, 4, 5,
2	**Identify** the personality and attitudes.	Apply	1,	1, 2, 5,
3	**Analyse** the group dynamics.	Analyse	2	1, 3,
4	**Inspect** conflict resolution modes.	Analyse	2	, 2, 5,
5	**Evaluate** the conflict resolution mode.	Evaluate	2	1, 2, 3, 4, 5,

TEXT BOOKS:

1.Luthans, Fred, "Organizational Behavior", 12th edition, McGraw Higher Ed, 2013.

REFERENCE BOOKS:

1.Debra L. Nelson, James Campbell Quick, "Organization Behavior", 8th edition, Cengage, 2013.

IMAGE SOURCE: https://www.feedough.com/wp-content/uploads/2021/11/organisational-behaviour.png

22MS853- PRINCIPLES AND PRATICES OF MANAGEMENT

Hours per weak

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basic knowledge on the management.

COURSE DESCRIPTION AND OBJECTIVES: The main object of the course is to explain about concepts, principles and practice of management. To imbibe in-depth knowledge to the students on planning, decision making, organizing and directing and controlling aspects of management.

MODULE-1

UNIT-1 **5L+10T+0P=15 Hours**

Introduction to Management: Concept of management, Management functions, Managerial roles, skills and levels, Is management science or art? History and current thinking: Classical approach, Behavioral approach, Management science approach, The contingency approach, The systems approach.

UNIT-2 **5L+10T+0P=15 Hours**

Planning & Decision Making: Concept of planning, Purpose of planning, Planning process, Management by objectives, defining decision making, Types of decisions, Decision making process, Decision making conditions, Group decision making and, Decision trees

PRACTICES:

- To know in-depth knowledge to the students on planning, decision making, organizing and directing and controlling aspects of management
- Evaluating the group decision making process
- To analyze and apply of different approach in different situations

MODULE-2

UNIT-1 **6L+9T+0P=15 Hours**

Organizing: Concept of organizing, organizing process, Organization structures, departmentation, Responsibility, authority and delegation, span of management

UNIT-2 **4L+11T+0P=15 Hours**

Directing: Concept of motivation, Theories of motivation: Process theories of motivation, Content theories of motivation, Strategies for motivating organization members, Concept of leadership, Trait approach to leadership, Situational approach to leadership, Communication process, Barriers to communication, Interpersonal communication in organization

Controlling: Concept of controlling, Controlling process, Types of control, Techniques of controlling

PRATICES:

- To identify how to organize the structure and responsibility of the organization and its process
- To analyze the theories and strategies that are used in motivating organization members

SKILLS:

- To be an expert planning and decision making process and maintain a structure in an organization
- To anaylze the theories and to know where to apply in situations

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Outline the various properties and **Apply** transform techniques on ppm.	Apply	1	1, 2, 3,
2	**Identify** the group decision techniques.	Apply	1, 2	1, 2,
3	**Analyse** the organisation structure and responsibility.	Analyze	1, 2	1, 2, 3,
4	**Inspect** the leadership styles.	Analyze	2	1, 2, 3,
5	**Evaluate** the communication process.	Evaluate	2	1, 2, 3

TEXT BOOKS:

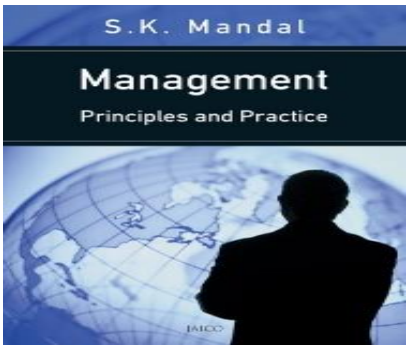
1. Samuel C.Certo, S.Trevis Certo: Modern Management, 10/e, Prentice-Hall, New Delhi, 2007
2. Stoner, Freeman, and Gilbert, Jr. Management, 6/e, Pearson education, New Delhi, 2006.

REFERENCE BOOKS:

1. Heinz Weihrich, Harold Koontz: Management A Global perspective, 10/e, Tata McGraw Hill, 2007.
2. Daft, The New Era of Management, Thomson, 7/e, New Delhi, 2007.
3. Schermerhorn: Management, 8/e, Wiley, India, 2006.

IMAGE SOURCE:

https://www.google.co.in/url?sa=i&url=https%3A%2F%2Fwww.kobo.com%2Fgr%2Fen%2Febook%2Fmanagement-principles-and-practice



22MT851 - APPLIED OPERATIONAL RESEARCH

Hours per week :

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Plotting graphs, Basic matrix operations, solving simple linear equations.

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build a grasp of the concepts of linear programming problem, transportation, assignment problems and to apply these concepts to real time situations that require optimization of the outcome of a process through simplex, Modi and Hungarian algorithms.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

LINEAR PROGRAMMING:

Introduction to Linear Programming Problem (LPP):

Introduction to Operation Research, Scope of Operation Research,

Linear Programming: Introduction, Concept of Linear Programming Model, Development of LP Models, The essence of the simplex method; Setting up the simplex method; Types of variables, Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method; Duality, Formulation of Dual Problem, Sensitivity Analysis.

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATIONS OF LINEAR PROGRAMMING:

Relevant methods of solving LPP in Agricultural sectors, Military Applications, Production Management, Financial Management, Marketing Management, Personnel Management, Engineering Applications, Efficient Manufacturing, Energy Industry and other Commercial Sectors.

PRACTICES:

- Develop an LPP that represents a given situation with appropriate decision variables.
- Plot graphical solutions to given LP Problems involving two decision variables.
- Apply simplex method to solve given LPP.
- Analyse a given LPP for Duality.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

TRANSPORTATION AND ASSIGNMENT PROBLEMS:

Transportation and Assignment Problems: Introduction to Transportation Problems, Mathematical Model for a Transportation Problems, Types of Transportation Problems, Method of solving Transportation Problems: Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel's Approximation Method. Optimal solution by Modified Distribution Method (MODI).

Assignment Problem: Zero-One Programming Model for Assignment Problem, Types of Assignment Problem, Hungarian algorithm for the assignment problem. Branch and Bound Technique.

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATIONS OF TRANSPORTATION AND ASSIGNMENT PROBLEMS:

Suitable methods to solve Personnel Assignment Problems, Travelling Salesman Problems, Transportation Problems, Problems connected with Engineering, Management and other Commercial Sectors.

PRACTICES:

- Develop a transportation situation into a Transportation problem.
- Compute IBFS for a given TP through different methods.
- Analyze a transportation problem for Optimal solution.
- Develop a given situation into an assignment problem.
- Apply Hungarian method to solve a given assignment problem.

SKILLS:

- Formulate LPP.
- Identify Initial Solution.
- Resolve Degeneracy.
- Test a solution for optimality.
- Decide tie breaking choice.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Model a given situation into LPP	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Apply simplex method to solve LPP	Apply	1	1, 2, 5, 9, 10
3	Apply MODI method to solve transportation problem	Apply	2	1, 2, 3, 5, 9, 10
4	Apply Hungarian method to solve assignment problem	Apply	2	1, 2, 5, 9, 10, 12

TEXT BOOKS:

1. Taha Hamdy, "Operations Research – An Introduction", 10th edition, Prentice-Hall, 2016.
2. Paneerselvam, "Operations Research", PHI learning, 2016.

REFERENCE BOOKS:

1. Sharma J K, "Operations Research", Laxmi Publications, 6th Edition, 2017
2. Sharma S D, "Operations Research (Theory Methods & Applications)", Kedar Nath Ram Nath Publications, 2020th Edition.

3. Hiller and Lieberman, “Introduction to Operations Research”, SIE, McGraw Hill, 2017.

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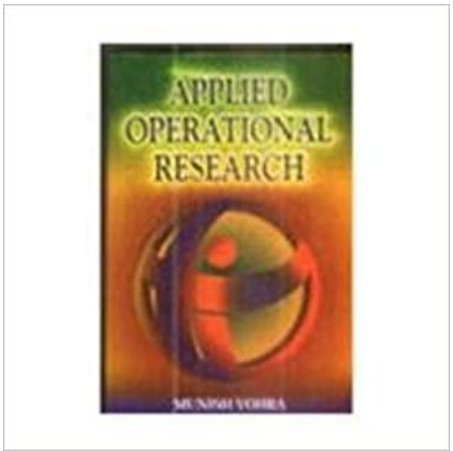


22MT852 – BUSINESS MATHEMATICS

Hours per week :

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Partial fractions.

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build a grasp of the fundamental concepts of calculus and matrices found in engineering. The methods of differentiation and integration is the primary focus. In addition, study of matrices is also included. Students will learn derivatives, integrals of various functions and apply them in their course of study. They also learn algebra of matrices and use these methods in their core subjects.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

CALCULUS:

Differentiation: Introduction to differentiation, Differentiation of Logarithmic and Exponential functions.

Introduction to functions of several variables, Partial derivatives, Total differentials, Implicit functions, Homogeneous functions.

Integration: Integration as anti-derivative process, Standard forms, Methods of integration by substitution, by parts, by use of partial fractions, Definite integration.

UNIT -2 **8L+8T+0P=16 Hours**

APPLICATIONS OF CALCULUS:

Maxima and minima, Conditions for extreme values.

Finding areas in simple cases, Consumers and producers' surplus, Nature of Commodities learning curve.

PRACTICES:

- Derivatives of functions.
- Partial derivatives.
- Implicit functions.
- Homogeneous functions.
- Integration of functions.
- Evaluation of definite integrals.
- Find extreme values of a function.
- Find areas using integration.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

MATRICES:

Definition of matrix; Types of matrices; Algebra of matrices, adjoint of a matrix, inverse of a matrix through adjoint and elementary row operations, Rank of a matrix, Echelon form, Normal form.

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATIONS OF MATRICES:

Solution of system of linear equations having unique solution and involving not more than three variables, Consistency of system of linear equations, Gauss elimination method and Gauss Jordan method.

PRACTICES:

- Addition and multiplication of matrices.
- Find adjoint of matrix and inverse of matrix.
- Compute rank of a matrix.
- Apply elementary operations on a matrix.
- Solve system of equations.

SKILLS:

- Examine a function for extreme values.
- Estimate the area of plane region using integration.
- Test the consistency of system of equations.
- Transform a matrix to echelon form.
- Transform a matrix to normal form.
- To find derivatives and integrals of functions
- Demonstrate methods of inversion of matrix and system of equations.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Outline the various methods and find the derivatives and integrals methods	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Identify suitable methods to find extreme values and areas	Apply	1	1, 2, 5, 9, 10
3	Analyse a matrix for its rank	Analyse	2	1, 2, 3, 5, 9, 10
4	Analyse system of equations for its solution	Analyse	2	1, 2, 5, 9, 10, 12

TEXT BOOKS:

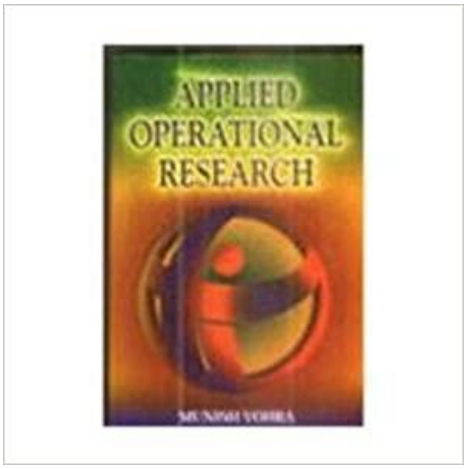
1. V. K. Kapoor, D.C. Sancheti "Business Mathematics", Sultan Chand and Sons, Delhi, 3rd Ed. 2019.
2. N. D. Vohra, Hitesh Arora "Quantitative Techniques in Management", Tata McGraw Hill, New Delhi, 2nd Ed, 2021.

REFERENCE BOOKS:

1. N. P. Bali, K. L. Sai Prasad, "A Textbook of Engineering Mathematics I, II, III", Universal Science Press, New Delhi, 2018, 2nd Edition.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44 Edition, 2018.

3. H. K. Dass and Er. Rajanish Verma, “Higher Engineering Mathematics”, S. Chand and Co., Third revised edition, 2015.
4. John Bird, “Higher Engineering Mathematics”, Routledge (Taylor and Francis Group), London, New York, 2018.

Image source: https://images-na.ssl-images-amazon.com/images/I/31AVqwFJl7L._SY298_BO1,204,203,200_.jpg



22MT853 - FINANCIAL MATHEMATICS

Hours per week :

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Elementary calculus, introductory knowledge of probability, skill on arithmetic operations and numerical ability.

COURSE DESCRIPTION AND OBJECTIVES:

This course introduces the students to the concepts in financial mathematics, a field of mathematics that uses mathematical and numerical models to make educated decisions in the face of uncertainty in the financial markets. The primary learning goals of this course are to introduce the concepts of financial mathematics and to provide an introduction to financial instruments related to financial mathematics as well as the usage of mathematical models for financial products thereby to develop student abilities to create, derive and apply mathematical models on financial and actuarial works.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

INTEREST RATES AND ANNUITIES:

Introduction, Calculator use of Interest, simple versus compound interest, compounding frequencies, continuous compounding, exercises of interest, Introduction to discounted cash flow valuation, Present values of cash flows, Perpetuities. Yield terms Nominal and annual rates of interest and discount, discounting and accumulating a single payment or a series of payments.

UNIT-2 **8L+8T+0P=16 Hours**

IRR AND NPV:

Present and accumulated values, Effective, Periodic, Inflation, Investment return, uneven cash flows. Introduction to interest rate financial instruments, Interest Rate Derivatives, Internal Rate of Return (IRR), Net Present Value (NPV) Problem, Return on Investment (ROI), Yield on Investment, Annuities, Annuity Due, Perpetuities, Calculator Quiz.

PRACTICES:

- Calculation of simple and compound interests.
- Differentiate simple versus compound interest.
- Calculation of exercise of interest.
- Calculation of cash flows, nominal and annual rates of interest and discounts.
- Evaluation of inflation.
- Evaluation of investment return and uneven cash flows.
- Calculation of IRR and NPV.
- Evaluation of yield on investments.
- Calculating annuities, annuity due and perpetuities.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

DIVIDEND AND DISCOUNT:

Introduction to equities, Dividend discount models, Stock valuation, Introduction to asset allocation concepts, Margin and margin calculations, Instalments plans, Amortization plans, Loan amortization, Construction of amortization tables, Value at Risk.

Introduction to fixed income products, reading bond quotes, Bond vocabulary, calculating bond yield, Discounts and premiums, Sinking funds, Embedded options (on bonds), Preferred stock and convertibility. Term structure, Duration and convexity, Calculating Duration and Convexity.

UNIT-2 **8L+8T+0P=16 Hours**

FINANCIAL DERIVATIVE:

Introduction to financial derivative products: Options, Futures, Forwards, Swaps. Derivative Mathematics: Break Even, ITM, OTM, ATM, Net Debits and Net Credits, Swap terms, Conventions and uses.

Option Strategies, Bull/Bear Call/Put Spreads, Straddles, Strangles, Synthetics relations, Futures, Forward, Swaps, Immunization, Constructing hedged portfolios, Leverage.

PRACTICES:

- Modelling dividend discounts and stock valuations.
- Analyze margin and margin calculations.
- Designing installments plans and amortization plans.
- Evaluating loans amortization.
- Construction of amortization tables.
- Calculation of bond yield, discounts, premiums and sinking funds.
- Assessment on ITM, OTM.
- Assessment on ATM, Net debits and Net credits.

SKILLS:

- Calculate simple and compound interests.
- Calculate cash flows, nominal and annual rates of interest and discounts.
- Calculate bond yield, discounts, premiums and sinking funds.
- Evaluate inflation.
- Evaluate yield on investments.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply interest and discount concepts to the pricing of simple, fixed-income financial instruments and the assessment of investment projects.	Apply	1	1, 2, 4, 5, 9, 10, 12

2	Apply the concepts of classical financial products and can critically evaluate different offers of financial investment and the borrowing of money.	Apply	1	1, 2, 5, 9, 10
3	Apply the concepts of Options, Futures, Forwards, Swaps, Derivative Mathematics, Break Even, ITM, OTM, ATM, Net Debits and Credits Swap terms, Immunization and Leverage.	Apply	2	1, 2, 5, 9, 10, 12
4	Analyse the functionality and area of applications of IRR, NPV, ROI, Yield on Investments, modern financial instruments and their risk and opportunities.	Analyse	1	1, 2, 3, 5, 9, 10
5	Are proficient in the mathematical foundations on dividend discount models, Stock valuation and can able to analyse Amortization plans, Loan amortization, Construction of amortization tables, Value at Risk.	Analyse	2	1, 2, 5, 9, 10, 12

TEXT BOOKS:

1. Kevin J. Hastings, Chapman and Hall "Introduction to Financial Mathematics", CRC Press, 1st Edition, 2015.
2. Donald R. Chambers, Qin Lu, "Introduction to Financial Mathematics with Computer Applications", CRC Press, Taylor & Francis Group, 2021.

REFERENCE BOOKS:

1. Giuseppe Campolieti, Roman N. Makarov, "Financial Mathematics: A Comprehensive Treatment", CRC Press, Taylor & Francis Group, 2014.
2. Robert J. Elliott and P. Ekkehard Kopp, "Mathematics of Financial Markets", Springer-Verlag, New York, 1999.
3. Salih N. Neftci, "An Introduction to the Mathematics of Financial Derivatives", Academic Press, San Diego, 1996.

Image Source: https://thumbs.dreamstime.com/b/conceptual-photo-financial-mathematics-written-text-209736943.jpg

22MT854 – FINITE DIFFERENCES AND NUMERICAL ANALYSIS

Hours per week :

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basics of Integration, differentiation and polynomials.

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build a base for Numerical methods, which are the basic algorithms underpinning computer predictions in modern systems science. Such methods include techniques for simple optimisation, interpolation from the known to the unknown, linear algebra underlying systems of equations, ordinary differential equations to simulate systems, and stochastic simulation under random influences.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

ROOT FINDING METHODS, SYSTEM OF LINEAR EQUATIONS AND INTERPOLATION:

Absolute error, order of Convergence, Geometrical Description, method of successive approximation, Bisection method, Regula- Falsi method, Newton's Method. Gauss Seidal method, Crouts method, Triangularization method, Relaxation method. Interpolation- Finite differences, interpolation, Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae (with proof), errors in interpolation formula.

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATIONS:

Finding positive, negative and real root of algebraic and transcendental equation, Solution of simultaneous linear algebraic equation. n^{th} difference of a polynomial, finding missing terms in a sequence, sum of n terms in a series, finding polynomial using a given set of data, estimated values of a function inside and outside the given intervals of data.

PRACTICES:

1. Finding positive, negative and real root of algebraic and transcendental equation
2. Solution of simultaneous linear algebraic equation
3. estimating values of a function inside and outside the given intervals of data.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

NUMERICAL DIFFERENTIATION, INTEGRATION AND DIFFERENTIAL EQUATION:

Numerical Differentiation: Newton's forward and Backward formulas to compute up to second order differentiation of a function.

Numerical Integration: Trapezoidal and Simpson's 1/3 and 3/8 rules.

ODE: Picard's approximation, Milne's Predictor Corrector formulas.

PDE: Liebman's Iteration Process, Bender Schmidth.

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATIONS:

Finding maxima and minima of a function, population growth, acceleration, area bounded by the curve, Solution of ODE, Solution of Elliptic, Parabolic and Hyperbolic PDE.

PRACTICES:

- Finding maxima and minima of a function
- Solve ODE numerically and plot the curve.
- Classify the PDE
- Solve PDE numerically and plot the curve.
- Developing difference equations from ODE and PDE.

SKILLS:

- Analyze the types and occurrence of roots.
- Interpolate the unknown values of function.
- Develop a difference equation.
- Gain the knowledge to solve an ODE numerically.
- Model a numerical algorithm or pseudocode.
- Demonstrate the various ways of finding solutions of ODE and PDE.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply numerical methods to find roots	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Evaluate the unknown values using interpolation	Apply	1	1, 2, 5, 9, 10
3	Develop a finite difference scheme	Analyze	2	1, 2, 3, 5, 9, 10
4	Apply numerical methods to solve ODE and PDE and analyse graphically	Analyze	2	1, 2, 5, 9, 10, 12

TEXT BOOKS:

1. P Kandasamy, “Numerical Methods”, S Chand, 2nd ed, 2015.
2. Gupta C.B., Singh S.R. and Mukesh Kumar: “Engineering Mathematics for Semester I & II”, Mc-Graw Hill Education (India) Pvt. Ltd., 2015.

REFERENCE BOOKS:

1. S. S. Sastry, “Introductory methods of numerical analysis”, 5th ed, PHI learning, 2012.
2. M K Jain, “Numerical Methods for Scientific and Engineering Computation”, New Age internarnational,2003.
3. C. Ray Wylie, Louis C. Barrett: “Advanced Engineering Mathematics", 6" Edition, 2. McGraw-Hill Book Co., New York, 1995.

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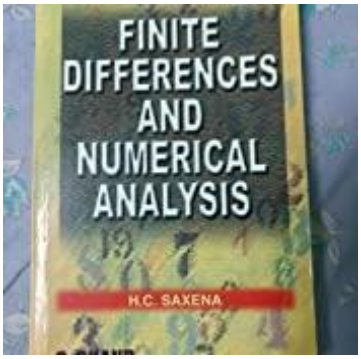

22MT855 - FUZZY MATHEMATICS

Hours per week :

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basics of crisp sets, relation and function, propositional logic.

COURSE DESCRIPTION AND OBJECTIVES:

To develop the fundamental concepts such as fuzzy sets, operations and fuzzy relations and learn about the fuzzification of scalar variables and defuzzification of membership functions. To learn three different inference methods to design fuzzy rule-based system. Learn different fuzzy classification methods and develop fuzzy controller. It covers the fundamental standards of thinking in light of surmised thinking; it is an outline of utilizations of fuzzy sets to different fuzzy points. It will furnish understudies with the information to figure out uses of fuzzy concepts.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

FUZZY SETS AND FUZZY RELATION:

Fuzzy sets: Classical sets, Fuzzy sets, Membership functions, Fuzzy set operations, Properties of fuzzy sets, level cuts and its properties

Fuzzy relations: Cartesian product, Fuzzy relations-cardinality, Operations, Properties of fuzzy relations, fuzzy Cartesian product and composition, Fuzzy tolerance and equivalence relations.

UNIT-2 **8L+8T+0P=16 Hours**

FUZZY SYSTEMS:

Fuzzification and defuzzification: Features of the membership functions, Various forms, Fuzzification, Defuzzification to crisp sets, cut of fuzzy relation, Defuzzification to scalars. Fuzzy logic and approximate reasoning, other forms of the implication operation.

PRACTICES:

- Representation of fuzzy sets.
- Determine the degree of membership of elements in Fuzzy sets.
- Tell us about crisp and fuzzy sets and find its difference.
- Determine operation on fuzzy sets.
- Convert crisp value to fuzzy value and convert fuzzy value to crisp value.
- Mention the features of Fuzzification and Defuzzification.
- Find the conditions for Defuzzification.
- Different modes of approximate reasoning in fuzzy.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

FUZZY CLASSIFICATION:

Fuzzy Rule Base, Fuzzy Inference Engine, Fuzzifier, Defuzzifier, Mathematical Representations of Fuzzy System, The Approximation Properties of Fuzzy Systems.

UNIT-2 **8L+8T+0P=16 Hours**

DESIGN OF FUZZY CONTROLLERS:

Design of Fuzzy Controllers: Application of Fuzzy knowledge-based controllers (washing machines traffic regulations, lift control, aircraft landing control).

PRACTICES:

- Study on three different methods of Defuzzification.
- Interpretations of Fuzzy IF-THEN Rules
- Characteristics of Fuzzy Inference System
- methods of FIS, having different consequent of fuzzy rules −
  a) Mamdani Fuzzy Inference System
  b) Takagi-Sugeno Fuzzy Model (TS Method)
- CADIAG-2, An Expert System for Medical Diagnosis
- SPERIL I, an Expert System to Assess Structural. Earthquake engineering has become an important discipline in areas in which the risk of earthquake is quite high.
- Use Fuzzy Logic in Control Systems
- Application of fuzzy controller in:
  a) Crane Control
  b) Control of a Model Car
  c) Control of a Diesel Engine
  d) Fuzzy Control of a Cement Kiln

SKILLS:

- The history of fuzzy logic; methodology of system modeling; main case of system modeling.
- Types of uncertainty; concept of fuzziness; linguistic variables.
- Rules in knowledge representation, fuzzy rules, models, inference.
- Fuzzy design systems.
- Planning and decision making under uncertainty condition.
- Model fuzzy linguistics conditions for different uncertainty conditions like Fuzzy expert system for drinking water, Design Rainfall prediction model.
- Fuzzy system for a patient goes to the doctor and the doctor has to diagnose so that medicine can be prescribed.
- Demonstrate different control system which suits for different engineering applications and compare with different systems.

COURSEOUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the basic ideas of fuzzy sets, operations and properties of fuzzy sets and also about fuzzy relations	Apply	1	1, 2, 9, 10
2	Apply the basic features of membership functions, fuzzification process and defuzzification process	Apply	1	1, 2, 3, 9, 10
3	Design fuzzy rule-based system.	Analyse	2	1, 2, 3, 5, 9, 10
4	Evaluate fuzzy controller and its applications.	Evaluate	2	1, 2, 3, 4, 5, 9, 10, 12

TEXT BOOKS:

1. S. Rajasekaran, G. A. Vijayalakshmi, "Neural Networks and Fuzzy logic and Genetic Algorithms", 2nd edition, Synthesis and Applications, PHI, New Delhi, 2017.
2. George J. klir, Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", 1st Ed.2015.

REFERENCE BOOKS:

1. Timothy J. Ross - Fuzzy logic with engineering applications, 3rd edition, Wiley,2011.
2. Zimmerman, Fuzzy Set Theory and its applications, Allied Publishers Pvt Ltd; 2nd Ed. 2011
3. Kevin Passino, Steve Yurkovich, "Fuzzy Control", 1st edition, Pearson, 1997.

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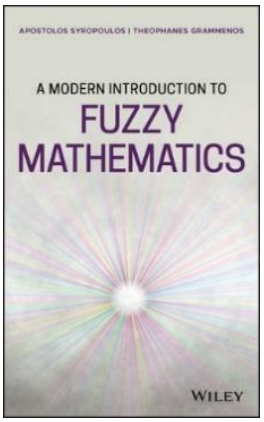

22MT856 –GRAPH THEORY

Hours per week :

L	T	P	C
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Mathematical proof technique (induction, proof by contradiction), and linear algebra (determinants, eigenvalues).

COURSE DESCRIPTION AND OBJECTIVES:

The objective of the course is to apply graph theory-based tools in solving practical problems, to develop the geometric duals in Planar Graphs, to apply the concept of matrices in graphs like Incidence matrix, Adjacency matrix, Cycle matrix etc. and to introduce the idea of coloring in graphs.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

GRAPHS:

Origin of graph theory, Graphs and Graph models, Graph terminology and special types of graphs, representing graphs and Graphs isomorphism.

UNIT-2 **8L+8T+0P=16 Hours**

TYPES OF GRAPHS

Types of Graphs: Complete graph, cycle graph, wheel graph, bipartite graph, star graph, Path graph.
Walks: Trail, Path, Length of the path, cycle and circuits. Connectivity, Euler and Hamiltonian Paths, distance in graphs

PRACTICES:

- Draw various types of graphs and graph models.
- Explore the different types of graph terminology and determine the different types of graphs.
- Take real time situation as a graph model and represent as adjacent matrix and incidence matrix, verify these matrices are symmetric or not.
- When two or more graphs are given, verify whether these graphs are isomorphic or not and prepare isomorphic graph models.
- Explore different types of paths and give the connection between these graphs.
- Identify the difference between Euler graphs and Hamiltonian graphs.
- Find the shortest path distances in graphs.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

TREES:

Trees, Forests, distance in trees, rooted and binary tree, spanning trees, minimal Spanning trees, Prim’s algorithm to find minimal spanning tree.

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATIONS OF GRAPHS:

Operations on graphs: union and intersection of graphs, Colouring, Chromatic number, Chromatic polynomial.

PRACTICES:

- Explore trees and forests; determine the difference between trees and forests.
- Identify the difference between rooted and binary trees.
- Determine the differences between spanning trees and minimal spanning trees.
- Find the minimal spanning trees using prims algorithm.
- Find the operations on graphs, apply these operations on two or more graphs, and observe the properties of graphs before and after operations.
- Find the relation between coloring and chromatic number.

SKILLS:

- Prepare a graph model using our college blocks and class rooms.
- Identify isomorphic graphs using algorithms.
- Identify Euler and Hamiltonian paths in bus roots of our college from different places.
- Take a graph and find the different spanning trees.
- Take India map and color the states with different color and find the chromatic number.
- Prepare isomorphic graphs with some with strips.
- Demonstrate coloring of a graph taking one graph model and determine the chromatic number.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Outline the various types of paths and Apply isomorphism in graphs.	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Identify the Euler and Hamiltonian graphs and find the chromatic number of any given graph.	Apply	1, 2	1, 2, 5, 9, 10
3	Analyse the spanning trees and shortest paths.	Analyze	1, 2	1, 2, 3, 5, 9, 10
4	Inspect four colour theorems.	Analyze	2	1, 2, 5, 9, 10, 12
5	Evaluate the properties of various trees and different types of graphs.	Evaluate	1, 2	1, 2, 3, 4, 5, 9, 10, 12

TEXT BOOKS:

1. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science" Dover Publications, Reprint 2016.
2. C L Liu, D P Mohapatra, "Elements of Discrete Mathematics-A Computer Oriented Approach", Tata McGraw Hill, 4th Ed. 2017.

REFERENCE BOOKS:

1. Singh. S.B., Jai Kishore, Ekata, “Discrete Structures”, Khanna Publishing; 3rd Ed. 2017.
2. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, McGraw Hill; 8th Ed. 2021.
3. Bondy. J.A and Murthy. U. S. R, “Graph theory with applications”, Macmillan publisher, New Ed. 2011.

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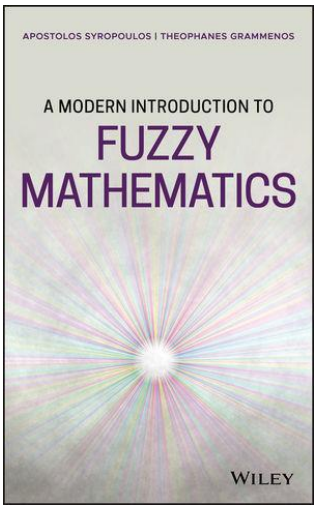

22MT857-INDUSTRIAL MATHEMATICS

Hours per week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: ODE, PDE.

COURSE DESCRIPTION AND OBJECTIVES:

The objective of the course is to introduce the concepts of Mathematical modelling, solve mathematical models using differential equations analyse the solutions of the models for their stability and to develop simulations to the models.

MODULE-1

UNIT-1 **8L+8T+0P=16 hours**

FUNDAMENTALS OF MODELING:

Models, properties of models, principles of modeling, Classification of models.

Introduction of Mathematical Modeling: Definition, formulation of mathematical models, Importance and Applications of Mathematical Modeling, Classification of Mathematical Modeling, merits and demerits of Mathematical Modeling.

UNIT-2 **8L+8T+0P=16 hours**

DYNAMICS OF MATHEMATICAL MODELING:

Discrete & Continuous Time Mathematical Models: Motivation, General Theory and Analytical methods, Optimization of discrete and continuous models, examples based on discrete and continuous models, Stability Analysis.

PRACTICES:

- Formulate a mathematical model.
- Optimize discrete mathematical models.
- Optimize continuous mathematical models.
- Analyse the stability of a model.

MODULE-2

UNIT-1 **8L+8T+0P=16 hours**

APPLICATIONS OF ODE AND PDE IN SOLVING MATHEMATICAL MODELING:

Bacteria growth and decay models, Radio Activity and Carbon Dating, Temperature rate of change, biological growth models, Models of chemical processes, Models of Electrical Network, Traffic flow models.

UNIT-2 **8L+8T+0P=16 hours**

INTRODUCTION OF SIMULATION:

Definition, Steps for simulation models, types of simulation, Importance & scope of simulation, merits and demerits of simulation, Generation of Random numbers, Monte Carlo simulation, Steps for Monte Carlo simulation, Importance and scope of Monte Carlo simulation, merits and demerits of Monte Carlo simulation, illustrations based on Monte Carlo simulation techniques.

PRACTICES:

- Model Bacteria growth and decay.
- Model Radio Activity and Carbon Dating.
- Model Temperature rate of change.
- Model Biological growth models.
- Model of chemical processes.
- Model Electrical Network.
- Model Traffic flow.

SKILLS:

- Develop a mathematical model.
- Solve mathematical models using differential equations.
- Analyse the solutions of the models for their stability.
- Develop simulations to the models.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Model a given situation into a Mathematical Model	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Apply ODE and PDE to solve a Mathematical Model	Apply	2	1, 2, 5, 9, 10
3	Apply Monte Carlo simulation method	Apply	2	1, 2, 5, 9, 10, 12
4	Analyse a model for stability	Analyse	1, 2	1, 2, 3, 5, 9, 10

TEXT BOOKS:

1. Kapur J. N., "Mathematical Modeling", New Age International Private Limited; 2nd Ed, 2021.
2. Ahsan Zafar, "Differential equations and their applications", PHI learning Pvt. Ltd., 2016.

REFERENCE BOOKS:

1. Wang Hao, "Mathematical Modeling I: Preliminary", Bookbon.com, The ebook Company, 2012.
2. Veerarajan T. "Probability, Statistics and Random Processes", Tata McGraw Hill Education Pvt. Ltd., New Delhi ,2008.

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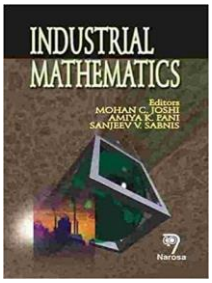

22MT858 –INTEGRAL TRANSFORMATIONS

Hours per week :

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Complex numbers, Basics of Integration, and differentiation.

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build a grasp of the fundamental concepts of the Laplace transforms and Fourier transforms. The course is designed as an introduction to the theory and applications of integral transforms to problems in linear differential equations, to boundary and initial value problems in partial differential equations. On successful completion of the course students will be able to recognize the different methods of finding Laplace transforms and Fourier transforms of different functions. They apply the knowledge of Laplace Transform and Fourier Transforms in finding the solutions of differential equations, initial value problems and boundary value problems.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

LAPLACE TRANSFORMATIONS:

Introduction, Definition, Sufficient condition of Existence, transforms of elementary functions, Properties, transforms of derivatives and integrals, Inverse Laplace Transforms, Inverse Laplace transform by partial fraction method, Convolution Theorem, Inverse Laplace transform by convolution theorem.

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATION OF LAPLACE TRANSFORM TO DIFFERENTIAL EQUATIONS:

Applying Laplace transforms to solve differential equations with constants co-efficient, simultaneous ordinary differential equations with constant coefficients, partial differential equations.

PRACTICES:

- Determine whether Laplace transform exist or not for the given arbitrary function.
- Compute the Laplace transforms of arbitrary functions.
- Use the Laplace transform to compute the convolution between the functions.
- Use tables to compute inverse Laplace transforms.
- Suppose that a differential equation with boundary values given, Use Laplace transforms as a technique for solving differential equations.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

FOURIER TRANSFORMS:

Introduction, Definition, Fourier integral theorem (statement only), Fourier sine and cosine integrals, Fourier transforms, Fourier sine and cosine transforms, properties of Fourier transforms, Inverse transforms.

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATIONS OF FOURIER TRANSFORMS:

Convolution theorem for Fourier transforms, Parseval's Identity, Applications of Fourier transforms to boundary value problems.

PRACTICES:

- Compute the Fourier transforms of arbitrary functions.
- Use the Fourier transform to compute the convolution between the functions.
- Compute the integral value.by using Parseval's identity.
- Use tables to compute inverse Fourier transforms.
- Suppose that a differential equation with boundary values given, Use Fourier transforms as a technique for solving differential equations.

SKILLS:

- Analyze the given function and check the existence of Integral transforms.
- Ability to solve problems by converting them from one domain where the solution is done through a complex mathematical procedure to another domain where simple algebraic methods can solve them.
- Choose the various transforms and their applications in the analysis of real valued and complex valued functions.
- Able to apply transforms to solve problems in many areas of mathematics and engineering.
- Convert the complicated differential equation into an equation solvable through analytic means and then transform back.
- Demonstrate the relationship between the inverse transform of two functions by using convolution theorem.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply Fourier transform to solve differential equations which will be converted to algebraic equation.	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Apply Integral transform techniques to solve research problems of signal processing, data analysis and processing, image processing, in scientific simulation algorithms etc.	Apply	1, 2	1, 2, 5, 9, 10
3	Analyse the real-world problems of sciences and engineering and use Integral transforms to solve it.	Analyze	1, 2	1, 2, 3, 5, 9, 10
4	Analyse the characteristics and properties of Laplace & Fourier transforms.	Analyze	2	1, 2, 5, 9, 10, 12

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna publishers,44th Edition,2017.
2. Jain R.K., Iyengar S. R. K., "Advanced Engineering Mathematics", Narosa Publishers, Reprint 2019.

REFERENCE BOOKS:

1. Goyal, J. K. & Gupta K. P., "Laplace And Fourier Transforms", Meerut: Pragati Prakashan.29th Ed. 2016.
2. Vasistha, A. R. & Gupta R. K., "Integral Transforms", Meerut: Krishna Prakashan.4th Ed. 2014.
3. Sreenadh, S., "Fourier Series and Fourier transform", S. Chand & Co Private Limited, New Delhi 2nd Ed, 2014.

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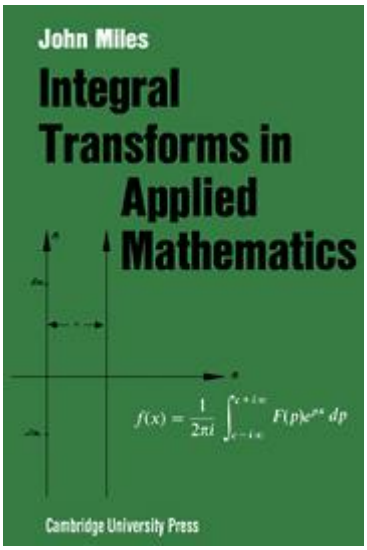

22MT859 -MATHEMATICAL CRYPTOGRAPHY

Hours per week :

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Number theory concepts.

COURSE DESCRIPTION AND OBJECTIVES:

This course will emphasize on principles and practice of cryptography and network security: classical systems, symmetric block ciphers (DES, AES, other contemporary symmetric ciphers), linear and differential cryptanalysis, perfect secrecy, public-key cryptography algorithms for factoring and discrete logarithms, cryptographic protocols. This course provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures. This course explain various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes and familiarize Digital Signature Standard and provide solutions for their issues.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

INTRODUCTION TO CRYPTOGRAPHY:

Simple substitution ciphers, Divisibility and greatest common divisors, Modular arithmetic Prime numbers, unique factorization, and finite fields, Powers and primitive roots in finite fields, Symmetric and asymmetric ciphers, Discrete Logarithms and Diffie–Hellman, The ElGamal public key cryptosystem, A collision algorithm for the DLP, The Chinese remainder theorem.

UNIT-2 **8L+8T+0P=16 Hours**

INTEGER FACTORIZATION AND RSA:

Euler's formula and roots modulo pq, The RSA public key cryptosystem, Implementation and security issues, Primality testing, Pollard's $p - 1$ factorization algorithm, Factorization via difference of squares, Smooth numbers and sieves, The index calculus and discrete logarithms, Quadratic residues and quadratic reciprocity, Probabilistic encryption.

PRACTICES:

- Use the Euclidean Algorithm to find gcd(26, 14).
  (a)Hence explain why 14 does not have a multiplicative inverse in Z26.
  (b) Use the Euclidean Algorithm to find gcd(26, 23).
  (c) Find the multiplicative inverse of 23 in Z26.
- Consider an affine cipher with the key K = (a, b) = (5, 6).
  (a) Find the ciphertext corresponding to the plaintext hello.
  (b) Find the plaintext corresponding to the ciphertext OGVOGT.
  (c) Determine which letters remain unchanged when encrypting using this key.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

COMBINATORICS, PROBABILITY AND INFORMATION THEORY:

Basic principles of counting, The Vigen`ere cipher, Collision algorithms and meet-in-the-middle attacks, Pollard's ρ method, Information theory, Complexity Theory and P versus N P.

UNIT-2 **8L+8T+0P=16 Hours**

ELLIPTIC CURVES AND CRYPTOGRAPHY:

Elliptic curves over finite fields, Elliptic curve cryptography, The evolution of public key cryptography, Lenstra's elliptic curve factorization algorithm, Applications of the Weil pairing, The NTRU public key cryptosystem, NTRU as a lattice cryptosystem, Lattice reduction algorithms

PRACTICES:

- The index of coincidence for German is 0.0762. Determine a formula for m, the most likely keyword length, for cipher text obtained from German plaintext using the Vigenere cipher.
- Consider the implementation of the row transposition cipher given on page 45 of the notes with the keyword SCRAMBLE.
  (a) Encrypt the plaintext thoroughly mixed.
  (b) Decrypt the cipher text EAAERCKTNEHRAREWGNALGINRESTXXRTE.
  (c) Write down the permutation π for this row transposition cipher in one-line cycle form.

SKILLS:

- Encrypt the plain text to cipher text.
- Learning the concepts of combinatorics and probability
- NTRU technique
- Lattice reduction algorithm
- Security and control.
- A plaintext message was encrypted using the ADFGVX cipher with the keyword CIPHER and the following 6 × 6 array. (Note that the entry in the AA cell is a zero, not the letter O.

	A	D	F	G	V	X
A	0	A	D	G	1	J
D	M	2	P	S	V	3
F	Y	B	4	5	E	H
G	6	K	N	Q	T	7
V	W	8	Z	C	F	I
X	L	O	R	U	9	X

- The cipher text FXFFDAXDGGDXVGGXDX was received. Determine the plaintext message.

COURSEOUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the divisibility concepts in public key cryptosystem	Apply	1	1,2, 9,10,12
2	Apply the concepts of factorization algorithm in RSA public key cryptosystem	Apply	1	1,2, 9,10,12
3	Apply the concept of combinatorics and probability in complexity theory	Apply	2	1,2, 9,10,12
4	Validate the concept of elliptic curve cryptography and NTRU crypto system	Evaluate	2	1,2, 9,10,12

TEXT BOOKS:

1. Jeffrey Hoffstein, Pipher and Silverman, "An introduction to mathematical cryptography", Springer, Reprint 2016.
2. William Stallings, "Cryptography and Network Security: Principles and Practice", 7th edition Pearson Education, India, 2016.

REFERENCE BOOKS:

1. Atul Kahate, "Cryptography and Network Security", 2nd edition, Tata Mc Grawhill, India, 2008.
2. Robert Bragg, Mark Rhodes, "Network Security: The complete reference", Tata Mc Grawhill, India, 2004.
3. Charlie Kaufman, "Network Security: Private Communication in a Public World,' 2nd edition, Prentice Hall of India, New Delhi, 2002

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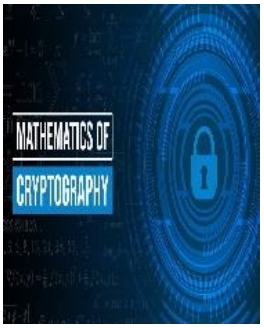

22MT860 - NUMBER THEORY

Hours per week :

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Knowledge on divisibility, prime numbers, fundamental arithmetic functions.

COURSE DESCRIPTION AND OBJECTIVES:

This course aims at building a durable base on the concepts of counting function, number theorem, congruence relation and its properties thereby, this course intended to develop skills on the concepts of modulo arithmetic, primitive arithmetic roots, composite number and Euler's criterion. Further, it encompasses many important theorems and results such as Chinese remainder theorem, Fermat's theorem, Wilson's theorem, Mobius inversion formula, Euler's Phi-function, Legendre symbol, quadratic reciprocity and congruencies etc. Moreover, this course covers some important applications on encryption and decryption.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

DISTRIBUTION OF PRIMES AND THEORY OF CONGRUENCIES:

Linear Diophantine equation, Prime counting function, Prime number theorem, Goldbach conjecture, Fermat and Mersenne primes, Congruence relation and its properties, Linear congruence and Chinese remainder theorem, Fermat's little theorem, Wilson's theorem.

UNIT-2 **8L+8T+0P=16 Hours**

NUMBER THEORETIC FUNCTIONS:

Number theoretic functions for sum and number of divisors, Multiplicative function, The Mobius inversion formula, the greatest integer function. Euler's phi-function and properties, Euler's theorem.

PRACTICES:

- Determine primes and divisibility.
- Find the primitive roots and quadratic reciprocity.
- Evaluate the sum and the number of divisors.
- Use multiplicative function to determine the sum and the number of divisors.
- Use greatest integer function to find the number of divisors.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

PRIMITIVE ROOTS:

Modulo arithmetic, the order of an integer modulo n, Primitive roots for primes, Composite numbers having primitive roots; Definition of quadratic residue of an odd prime, and Euler's criterion.

UNIT-2 **8L+8T+0P=16 Hours**

QUADRATIC RECIPROCITY LAW AND PUBLIC KEY ENCRYPTION:

The Legendre symbol and its properties, Quadratic reciprocity, Quadratic congruencies with composite module.

Applications: Public key encryption, RSA encryption and decryption.

PRACTICES:

- Use Mobius inversion formula to analyze the sum and the number of divisors.
- Evaluate divisors, common divisors.
- Perform divisibility tests.
- Determine congruences and check digits.
- Verification of Euler's theorem for the given number theoretic function.

SKILLS:

- Analyze the given function and check the existence divisors.
- Ability to Find the primitive roots and quadratic reciprocity.
- Ability to perform divisibility tests and to find the primitive roots and quadratic reciprocity.
- Able to verify Euler's theorem for the given number theoretic function.
- Determine multiplicative inverse, modulo n, Legendre symbol, quadratic reciprocity and congruencies.
- Determine divisors, quotients, prime counting and multiplicative functions.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Acquire knowledge on Linear Diophantine equation.	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Determine divisors, quotients, prime counting and multiplicative functions.	Apply	1, 2	1, 2, 5, 9, 10
3	Analyse the concepts of Euler's theorem and Mobius inversion formula.	Analyse	1, 2	1, 2, 3, 5, 9, 10
4	Analyse the concepts composite numbers, primitive roots, quadratic residue and Euler's criterion.	Analyse	2	1, 2, 5, 9, 10, 12
5	Determine multiplicative inverse, modulo n, Legendre symbol, quadratic reciprocity and congruencies.	Analyse	1, 2	1, 2, 5, 9, 10, 12

TEXT BOOKS:

1. Jeffry Hoffstein, An introduction to mathematical cryptography. Springer publications, 2nd Edition, 2014.
2. David M. Burton, "Elementary Number Theory", 7th edition, 2007, McGraw-Hill

REFERENCE BOOKS:

1. N. P. Bali, “A Text Book on Number Theory”, Golden Series of Mathematics, Laxmi Publications, New Delhi.
2. Gareth A. Jones & J. Mary Jones, “Elementary Number Theory”, 2005, Springer.
3. Neville Robbins, “Beginning Number Theory”, 2nd edition, 2007, Narosa.

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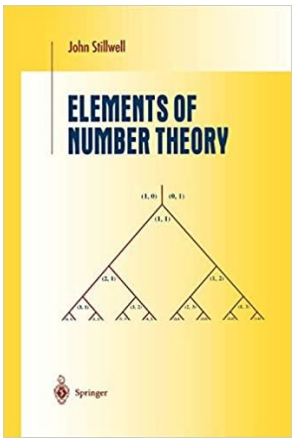

22MT861-OPTIMIZATION TECHNIQUES

Hours per week:

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basic matrix operations, solving simple linear equations, some fundamentals from Business Mathematics.

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build a grasp of the concepts of decision theory, game theory, project management techniques and to apply these concepts to real time situations.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

DECISION THEORY AND GAME THEORY:

Decision Theory: Decision making with and without experimentation, Decision Trees, Utility theory, Decision under risk: expected value, expected value - variance, aspiration - level, and most likely future criteria.

Game Theory: Introduction, Game theory terminology, the formulation of two persons, zero sum games, Game with Mixed Strategies, Game with Mixed Strategies, Linear Programming Approach for Game Theory

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATIONS OF GAME THEORY:

Decision under uncertainty: Laplace criterion, Maximin criterion, Minimax criterion, Savage minimax regret criterion, Hurwicz criterion. Decision Tree.

Game Theory: Solving simple games- a prototype example; Games with mixed strategies, Product Choice Problems, Business games, Stock Trades.

PRACTICES:

- Apply dominance property to solve a given game.
- Identify saddle point of a game
- Apply simplex method to solve given Game.
- Analyze a given game for its optimal strategies and game value.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

PROJECT MANAGEMANT:

Introduction, Phase of Project Management, Rules of Network Construction, Project scheduling: P.E.R.T. & C.P.M.: Definitions, various terms used in networking, drawing networks, identifying critical path – probability of completing the project within given time.

UNIT-2 **8L+8T+0P=16 Hours**

APPLICATIONS OF P.E.R.T. AND C.P.M.:

Relevant method for solving problems under Equipment Maintenance and hauling, Construction Projects, Planning and launching of new products, Control of production, Market penetration programs.

PRACTICES:

- Draw network diagram of a given project satisfying predecessor and successor relations.
- Evaluate a given project for its optimal completion time using PERT/CPM.

SKILLS:

- Determine Saddle point of a game.
- Apply dominance property on a game.
- Calculate latest and earliest completion times of activities of a project.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply concepts of Decision theory for determine the nature and outcome of the decision.	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Apply various methods to solve a given game.	Apply	1	1, 2, 5, 9, 10
3	Apply Hungarian method to solve assignment problem	Apply	2	1, 2, 3, 5, 9, 10
4	Evaluate a given project for optimal time of completion	Evaluate	2	1, 2, 5, 9, 10, 12

TEXT BOOKS:

1. Taha Hamdy, "Operations Research – An Introduction", 10th edition, Prentice-Hall, 2016.
2. Paneerselvam, "Operations Research", PHI learning, 2016.

REFERENCE BOOKS:

1. Sharma J K, "Operations Research", Laxmi Publications, 6th Edition, 2017
2. Sharma S D, "Operations Research (Theory Methods & Applications)", Kedar Nath Ram Nath Publications, 2020th Edition.
3. Hiller and Lieberman, "Introduction to Operations Research", SIE, McGraw Hill, 2017.

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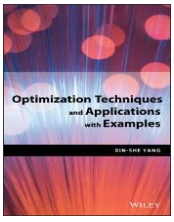

22MT862 –VECTOR SPACES

Hours per week :

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basics of set theory, relations and functions.

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to build a grasp of the fundamental concepts of vector space, subspace, linear span and mathematical applications of linearly independent and dependent vectors. To discuss inner product space, orthogonality of vectors and their applications namely Gram-Schmidt orthogonalization, QR Decomposition and Singular value decomposition. Further it is to study the linear transformation, matrix of linear transformation and to discuss the applications of linear transformation like as Eigen values and Eigen vectors of a square matrix, Cayley-Hamilton theorem and a power of matrix.

MODULE-1

UNIT-1 **8L +8T+0P=16Hours**

VECTOR SPACE:

Vector Space: Definition and examples of a vector space over real numbers (without problems), Subspace, Linear span, linearly independent and dependent sets, dimension of a vector space.

Quotient Space: Quotient space and direct sum of subspaces.

UNIT-2 **8L+8T+0P=16Hours**

INNER PRODUCT SPACE:

Inner product space: Inner product spaces (Definition only), orthogonality, Triangle inequality, Parallelogram law, Cauchy-Schwarz inequality.

Applications of Inner Product Space: Gram-Schmidt orthogonalization, QR Decomposition, Singular Value Decomposition of matrices.

PRACTICES:

- Determine the set of vectors is linearly independent or dependent.
- Discuss the examples of subspaces.
- Discuss the dimension of a quotient space.
- Discuss the geometrical interpretations of orthogonality.
- Discuss practice examples of QR decomposition.
- Discuss Singular Value Decomposition.

MODULE-2

UNIT-1 **8L+8T+0P=16Hours**

LINEAR TRANSFORMATIONS:

Linear Transformation: Definition and examples of linear transformations, Algebra of linear transformations, Rank and nullity of a linear transformation and rank-nullity theorem.

Matrix of Linear Transformations: Matrix of a linear transformation, Change of coordinates.

UNIT-2 **8L+8T+0P=16Hours**

EXTENSION OF LINEAR TRANSFORMATIONS:

Eigen Values and Eigen Vectors: Characteristic polynomial, Eigen values and Eigen Vectors of a square matrix, Cayley-Hamilton theorem (only statement) and powers of a matrix, Minimal polynomial.

Applications of Linear Transformations: Eigen values and Eigen vectors of a linear transformation.

PRACTICES:

- Verify the given transformation is linear transformation or not.
- Discuss the consequences of Rank-Nullity theorem.
- Discuss the matrix of linear transformation and change of coordinates.
- Discuss the Eigen values and Eigen vectors of a square matrix.
- Discuss the Cayley-Hamilton theorem and its applications.
- Discuss the minimal polynomial.
- Discusses Eigen values and Eigen vectors of a linear transformation.

SKILLS:

- Apply Singular Value Decomposition in Engineering.
- Apply Rank-Nullity theorem.
- Find the minimal polynomial from a given Characteristic polynomial.
- The general applications of Eigen values and Eigen vectors.
- Demonstrate the applications of vector spaces and matrix of linear transformations.
- Demonstrate inner product space with their applications.

COURSEOUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the concepts of vector spaces, subspaces, bases, dimension and their properties.	Apply	1	1, 2, 4, 5, 9, 12
2	Apply orthogonality in inner product spaces .	Apply	1	1, 2, 5, 9, 12
3	Relate matrices and linear transformations.	Analyse	2	1, 2, 3, 5, 9, 12
4	Compute Eigen values and Eigen vectors of linear transformations.	Evaluate	2	1, 2, 5, 9, 12

TEXT BOOKS:

1. A. R. Vasishtha, J. N. Sharma, “Linear Algebra”, Krishna Prakasan., New Ed, 2020.
2. Gilbert Strang, “Introduction to linear algebra”, Wellesley-Cambridge Press, 5th Ed. 2016.

REFERENCE BOOKS:

1. Kenneth Hoffman and Ray Kunze, “Linear Algebra”, 2nd edition, 2015, Prentice-Hall.

2. Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, “Linear Algebra”, 4th edition, Prentice-Hall of India Pvt. Ltd, 2003.
3. Serge Lang, “Introduction to Linear Algebra”, 2nd edition, 2005, Springer India.

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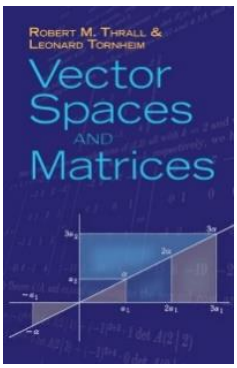

22ME851-3D PRINTING

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Manufacturing Technology.

COURSE DESCRIPTION AND OBJECTIVES:

This course offers advanced concepts of additive manufacturing techniques in 3D printing. The objective of this course to make students understand various rapid prototyping technologies and to select appropriate technologies for product development purposes.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

Introduction: Need for the compression in product development, Comparison with conventional manufacturing, History of 3D printing technology, Applications, Classification of RP systems.

RP Process: (LIQUID and SOLID TYPE): Principle, product design and development, Process parameters, introduction to liquid and solid type processes.

UNIT-2 **10L+10T+0P=20 Hours**

RP Process (Liquid and Solid Type): Process details and applications of Stereolithography systems, Solid Ground Curing, Liquid Thermal Polymerization (LTP), Process details and applications of Laminated object Manufacturing, Fused Deposition Modeling (FDP), Product design for FDM and wire arc additive manufacturing (WAAM).

MODULE-2

UNIT-1 **6L+6T+0P=12 Hours**

RP Process (Powder Type): Principle, Process parameters, Process details.

RP Process Optimization: Rapid manufacturing process, optimization, factors influencing accuracy, Data preparation errors, Part building errors, errors in finishing, influence of part build orientation.

UNIT-2 **10L+10T+0P=20 Hours**

RP Process Optimization: Applications of Laser Engineered Net Shaping, Selective Laser Sintering, Product design. Application of Different Parameters like Layer Thickness, Air Gap, Raster Orientation, Infill Density, Infill Pattern, Nozzle Temperature, Printing Speed, Raster angle, Application and Properties of different thermos- plastic materials: ABS, PLA.

SKILLS:

- Develop rapid prototypes to reduce product development time.
- Evaluate effect of process parameters in additive manufacturing.
- Design models using 3D printing technology.
- Design and produce models using 3D printing technology.
- Implement RPT technique in design and manufacturing of models.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Select appropriate 3D printing technique for a desired end-product.	Apply	1	1
2	Design and produce models using 3D printing technology.	Analyze	2	2
3	Evaluate effect of process parameters in additive manufacturing.	Evaluate	1	1,2
4	Evaluate various 3D printing techniques with respect to quality of product.	Evaluate	2	2

TEXT BOOKS:

1. Chua Chee Kai, Leong Kah Fai, 3D Printing and Additive Manufacturing: Principles & Applications, World Scientific, 4th Edition, 2015.
2. Ian Gibson, Davin Rosen, Brent Stucker "Additive Manufacturing Technologies, Springer, 2nd Edition, 2014.

REFERENCE BOOKS:

1. Additive Manufacturing: Principles, Technologies and Applications, C.P Paul, A.N Junoop, McGrawHill, 1st Edition, 2021.
2. Additive Manufacturing, Amit Bandyopadhyay Susmita Bose, CRC Press Taylor & Francis Group, 2nd Edition, 2020.
3. The 3D Printing Handbook: Technologies, Design and Applications, Redwood, Ben, Filemon Schoffer, and Brian Garret, 3D Hubs, 1st Edition, 2017.
4. William H Philips, "Additive manufacturing: opportunities, challenges, implications" Nova science publishers, 1st Edition, 2016.

Image source: https://www.google.com/search?q=3d+printing&source=lnms&tbm=isch&sa=X&ved=2ahUKEwji1re11fr5AhUjBLcAHTDKBGkQ_AUoAnoECAIQBA&biw=1366&bih=657#imgrc=6nFgEYWWucC3NM&imgdii=1U_Y4dq90t4EzM

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22ME852-OPERATIONS RESEARCH FOR ENGINEERS

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basics of Management Science

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with various management techniques including linear programming, sequencing, transportation and game theories. The objective of this course is to enable the students to apply linear programming, transportation, assignment and Inventory models for various engineering applications.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

Introduction to Linear Programming: LPP Formulation, Simple problem

Introduction to Transportation Problem: TP Formulation; Steps involved for getting IBFS by using North West Corner method, LCEM, VAM, Simple problems; Steps involved in MODI method for optimization.

Introduction to Assignment Problem: AP Formulation; Hungarian's assignment algorithm, Simple problem; Introduction to Travelling Salesman Problem, Simple problem.

Introduction to Job Sequencing Models: Johnson's algorithm, Simple problem.

UNIT-2 **10L+10T+0P=20 Hours**

Linear Programming: LP Problems solving related to practical application by using Graphical method & Simplex method.

Transportation Problem: TP Problems solving related to practical application by using North West Corner method, LCEM, VAM and also conduct optimality test by using MODI method.

Assignment Problem: AP Problems solving related to practical application by using Hungarian's assignment algorithm.

Sequencing Models: Job sequencing problems solving related to practical application by using Johnson's algorithm. TSP solving related to practical application by using Hungarian's assignment algorithm

PRACTICES:

- Optimize the product mix problem.
- Estimate the idle time & total elapsed time while performing manufacturing operations.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

Introduction to Waiting line models: Kendall's Lee notation, single channel with infinite population; Multichannel with infinite population.

Introduction to Inventory models: Deterministic models (i.e. EOQ and EBQ); Steps involved in purchase inventory models with one price break and multi price break when shortages are not allowed.

UNIT-2 **10L+10T+0P=20 Hours**

Waiting line models: Solving Queuing theory problems related to practical application under single channel & multichannel with infinite population.

Inventory models: Inventory problems solving related to practical application on EOQ, EBQ and Quantity discounts.

PRACTICES:

- Calculate EOQ and the number of orders in a year for practical inventory problem.
- Analyze queuing models for optimization of number of servers & service time.

SKILLS:

- Recognize the importance of Operations Research and mathematical modelling for solving practical problems in industries.
- Implement transportation and assignment solutions using appropriate optimization algorithms.
- Solve the sequencing problems.
- Apply game and queuing theory appropriately to solve problems.
- Analyse and apply inventory control and management techniques.
- LPP Model formulation for the agriculture problem.
- Travelling salesman problem for the shortest distance path.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Make use of the characteristics of different types of decision-making environments.	Apply	1,2	1, 2
2	Build and solve transportation and assignment models.	Apply	1	2,7
3	Improve decision making and develop critical thinking.	Apply	1,2	2, 3
4	Design simple sequencing models.	Analyse	1	2, 3

TEXT BOOKS:

1. Hiller and Liberman, "Introduction to Operations Research", Tata Mc Graw Hill, 2021.
2. Hamdy A Taha, Operations Research: An Introduction, Pearson Education, Inc., 10th Edition, 2017.

REFERENCE BOOKS:

1. Taha, "Introduction to Operations Research.", PHI Publications, 8th Edition, 2008.
2. D.S. Hira and R.K. Gupta, "Operations Research", S. Chand and Co., 5th Edition, 2008.
3. Manohar Mahajan, "Operation Research", Dhanpat Rai and Co., 1st Edition, 2008.

Image source: https://leverageedu.com/blog/scope-of-operation-research/
Image file name: Operations Research for Engineers.

22ME853-RELIABILITY ENGINEERING

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basics of Mathematics

COURSE DESCRIPTION AND OBJECTIVES:

This course applies the fundamental concepts of reliability engineering and their relevance to engineering systems. The objective of this course is to determine the reliability of the engineering systems encountered in the industry.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

Introduction: Terminology of Reliability, Types and Causes of Failures, Bathtub curve, Failure Distributions –Normal, Log – Normal, Weibull; Failure Data Analysis; Hazard Rate, Hazard Rate vs Failure Rate vs Reliability, Hazard Models – Constant, Linearly Increasing, Power Law; Reliability Estimation vs Reliability Prediction.

UNIT-2 **10L+10T+0P=20 Hours**

System Reliability: Part Stress Method, Part Count Method, Series Configuration, Parallel Configuration, Mixed Configuration.

PRACTICES:

- Reliability Prediction for a given failure rate or hazard rate.
- Reliability Computation for Series, Parallel and Mixed Configurations.

MODULE-2

UNIT-1 **6L+6T+0P=12 Hours**

Multi–State Systems: Markov process, Markov–Chain, Reliability of Two–state systems following constant Hazard rate and Repair rate.

UNIT-2 **10L+10T+0P=20 Hours**

Interference Theory: General Expression for Reliability, Reliability Computation – Normally distributed Stress and Strength, Log - Normally distributed Stress and Strength, Exponentially distributed Stress and Strength.

PRACTICES:

- Reliability Estimation of Multi-State systems using Markov Model.
- Reliability Estimation using Stress–Strength Interference Method.

SKILLS:

- Failure data analysis.
- Hazard Estimation.
- Reliability Prediction and Estimation.

- Prediction of reliability for a given failure rate or hazard rate.
- Reliability Computation for Series Configurations.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Estimate the Reliability for a specified failure rate or hazard rate.	Apply	1	1, 2, 9, 11
2	Predict the Reliability of a given system configuration.	Evaluate	1	1, 2,9, 11
3	Demonstrate the Reliability of multi-state systems.	Analyze	2	1,2,9
4	Propose the expected Reliability for randomly distributed Stress and Strength of Components.	Create	2	1,2,9

TEXTBOOKS:

1. Charles E. Ebling, "An Introduction to Reliability and Maintainability Engineering", Indian Edition**,** Tata Mc Graw Hill, 2017.
2. Alessandro Birolini, "Reliability Engineering: Theory and Practice", Springer, 8th Edition, 2017.

REFERENCE BOOKS:

1. L. S. Srinath, "Reliability Engineering", East-West Press, 4th Edition, 2016.
2. Elsayed A. Elsayed, "Reliability Engineering", Wiley, 2nd Edition, 2011.

Image source: https://qphs.fs.quoracdn.net/main-qimg-caa1625521dba35be9b7f9cad262c0e3-pjlq
Image file name: RELIABILITY ENGINEERING

22PY851 - ADVANCED ENGINEERING MATERIALS

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basics of quantum mechanics and solid-state physics.

COURSE DESCRIPTION AND OBJECTIVES

This course is intended to Identify and describe the properties of different types of advanced engineering materials, their characterization, and the ability to select suitable material for specific application.

MODULE-1

UNIT-1 **10L +0T+10 P = 20Hours**

NANOMATERIALS & BIOMATERIALS:

Nano Materials: Classification of nanomaterials, Physical, chemical, electrical, and mechanical properties of nanomaterials. Synthesis of nanomaterials by Physical and chemical vapour deposition techniques, carbon-nano tubes (CNT), Nano sensors, Quantum dots.

Biomaterials: Biomaterials, Bioceramics, Biopolymers, tissuegrafts-soft tissue applications, cardiovascular implants, biomaterials in ophthalmology, Orthopedic implants, and dental materials.

UNIT-2 **6L +0T+ 6P = 12Hours**

COMPOSITES:

General characteristics of composites, composites classes, PMCs, MMCs,CMCs, CCCs, IMCs, hybrid composites, fibers and matrices, different types of fibers,whiskers, different matrix materials, polymers, metal, ceramic matrices- toughening mechanism- interfaces.

PRACTICES:

- Synthesis of nanomaterial using sol-gel method.
- Determination of physical properties of composite material.l
- Testing biocompatibility of nanomaterial,

MODULE-2

UNIT-1 **6L +0T+ 6P = 12Hours**

SUPER CONDUCTING & SMART MATERIALS:

Super Conducting Materials: Introduction to superconductors-Types of superconductors, high Tc superconductors, potential applications of superconductivity, electrical switching element, superconductor power transmission and transformers, magnetic mirror, bearings, superconductor motors, generators, SQUIDS etc.

Smart Materials: Piezoelectric materials, Rheological materials, chromic materials, Magnetostrictivive materials, Electro strictive materials and Shape memory alloys.

UNIT-2 **8L +0T+ 8P = 16Hours**

FUNCTIONAL MATERIALS & DEVICES:

Surface Acoustic Wave (SAW) Materials: Delay lines, frequency filters, resonators, pressure and temperature sensors, Sonar transducers.

Electrets: Electrets-Preparation- Comparison of electrets with permanent magnets- Applications.
Functional materials: Low dielectric constant materials, optoelectronic materials. Glassy and Nano crystalline materials for soft and hard magnetic properties and their applications.

PRACTICES:

- Determination of magnetic susceptibility of a given magnetic material.
- Measurement of the dielectric constant of a given material.
- Study on V-I characteristics of Light Emitting Diode.

SKILLS:

- Able to identify suitable Nano, bio and composites for different applications.
- Apply the low-temperature phenomenon for device applications.
- Realizing the role of functional materials.

COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to:

CO NO	Course outcomes	Blooms level	Module no	Mapping with POs
1	Apply the knowledge of synthesis and properties of nanomaterials in diversified fields	Apply	1	1, 2, 4, 5
2	Analyse the conceptual grasp on ceramics for suitable applications	Analyse	1	1, 2, 3, 4
3	Identify and categorize various superconducting materials for engineering applications	Analyse	2	1,3,4,5,6
4	Evaluate the characteristics of functional materials in view of device applications.	Evaluate	2	1,2,3,5

TEXT BOOKS:

1. T. Pradeep, "Nano: The Essentials", TATA McGraw-Hill, 1st edition, 2007.
2. C.Mouli Agrawal, Joo Ong, Mark R Appleford, Gopinath Mani, "Introduction to Biomaterials: Basic theory with Engineering Applications", Cambridge University Press, 1st edition, 2013.

REFERENCE BOOKS:

1. Krishan K Chawla, "Composite Materials", Springer, 2nd edition, 2006.
2. Gandhi, M.V., Thompson, B.S., "Smart Materials and Structures", Chapman and Hall, 2ndedition1992.
3. S. Banerjee and A.K. Tyagi, "Functional Materials: Preparation, Processing and Applications", First edition, Elsevier, 2011.
4. Gladius Lewis, "Selection of Engineering Materials", Prentice-Hall, New Jersey, 1995.
5. Rama Rao, P., "Advances in Materials and their applications", First edition, New Age International Pvt. Ltd., 2017.

22PY852-PHOTONICS

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basics of Quantum mechanics and optics.

COURSE DESCRIPTION AND OBJECTIVES:

This course is aimed at imparting knowledge onbasic principles of Nanoscience and properties of nanomaterials. Principles of photonics and devices.

MODULE- 1

UNIT-1 **10L +0T+ 10P = 20Hours**

NANOTECHNOLOGY:

Introduction to Nanotechnology, Physics of Nanotechnology, 0D, 1D, 2D, 3D nanomaterials, Synthesis methods of Nanomaterials, Physical properties of Nanomaterials, Optical behaviour of Nanomaterials, Applications.

UNIT-2 **6L +0T+ 6P = 12Hours**

PHOTONICS AT LOW DIMENSION:

Metal-dielectric interaction, Origin of plasmonics, Surface plasmon resonance, Plasmonic devices and their fabrication techniques and applications.

PRACTICES:

- Perform the exercise on surface to volume ratio of solids
- Synthesis of nanomaterials with different dimensions by physical vapour deposition methods
- Evaluate surface plasmon resonance behaviour of 0D nanomaterials for light scattering

MODULE- 2

UNIT-1 **10L +0T+10P = 20Hours**

NEAR FIELD OPTICS:

Introduction to Nano photonics and its true nature, Behaviour of light at lower dimension, Physical aspects of near field, Near field microscopy, Advantages and limitations, Principles of nanofabrication using optical near fields.

UNIT-2 **6L +0T+ 6P = 12Hours**

FUNDAMENTALS OF NANOFABRICATION:

Adiabatic and non-adiabatic nanofabrication's, Regulating the size and shape of nanoparticles, Self-assembling method via optical near field interactions, Photolithography, Nanophotonic device fabrication.

PRACTICES:

- Study of diffraction, scattering and interference phenomena of light.
- Realization of nanophotonic fabrication devices by using various principles.
- Explore various nanofabrication methods like lithography and sputtering.

SKILLS:

- Able to identify suitable Nano, bio and composites for different applications
- Apply the low-temperature phenomenon for device applications.
- Realizing the role of functional materials.

COURSE OUTCOMES:

Upon the completion of course, the student will be able to

CO NO	Course outcomes	Blooms level	Module no	Mapping with POs
1	Apply the quantum law for light matter interactions.	Apply	1	1, 2, 4, 5,
2	Analyse Photonic principles at low dimension.	Analyse	1	1, 2, 3, 4
3	Appraise the principles of Near field optics.	Evaluate	2	1,3,4,5,6
4	Evaluate light matter interaction for Photonic devices.	Evaluate	2	1,2,3,5

TEXT BOOKS:

1.MotoichiOhtsu, Kiyoshi Kobayashi, Tadashi Kawazoe, Takashi Yatsui and Makoto Naruse, "Principles of Nanophotonic", CRC Press, 1ed 2020.

2. P. N. Prasad, "Nano photonics", John Wiley & Sons, 3rd edition, 2019.

REFERENCE BOOKS:

1. S. V Gaponenko, "Introduction to Nanophotonic", Cambridge University Press, 2020.

2. Herve Rigneault, Jean-Michel Lourtioz, Claude Delalande and Ariel Levenson, "Nano photonics",ISTE Ltd, 2018.

3. Takashi Yatsui, "Progress in Nano photonics", Springer, 2021.

22PY853-PHOTOVOLTAICS& FUEL CELL TECHNOLOGY

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basics of electrochemical cell and Thermodynamics.

COURSE DESCRIPTION AND OBJECTIVES

This course introduces the basic principles of photovoltaic cells and fuel cells. This course emphasizes about the recent advances in solar PV technology and understanding of solar PV systems in power generation. This course also emphasizes about the application of fuel cell technology.

MODULE – 1

UNIT-1 **8L+0T+8P = 16 Hours**

FUNDAMENTALS OF PHOTOVOLTAIC CELL:

Introduction- Solar cell working, General Types, Testing of Solar cells, Design of solar cells-Cell parameters limits, Losses in solar cells, Solar cell design for high I_{sc}, V_{oc} and FF, PV device characterization. Factors affecting the efficiency of solar cell, Strategies to enhance the efficiency of solar cell.

UNIT-2 **8L+0T+8P = 16 Hours**

RECENT ADVANCES & PV SYSTEM APPLICATIONS:

Emerging solar cell technologies (Organic PV, Dye Sensitized Solar cell - Perovskite solar cells), Multijunction solar cells, Solar PV system, Design methodology of PV off grid and grid connected systems, Load estimation and System Sizing, Design of roof top solar PV power plants.

PRACTICES:

- Determination of the efficiency of a solar cell.
- Study the electrical power output from two solar cells in a series and two solar cells in parallel.
- Investigating the effect of distance between light source and solar cell on the efficiency of the solar cell.

MODULE – 2

UNIT-1 **8L+0T+8P = 16 Hours**

INTRODUCTION TO FUEL CELLS:

History, principle, working of fuel cells, thermodynamics and kinetics of fuel cell processes; concept of electrochemical potential and Nernst equation, performance and evaluation of fuel cell; Comparison of battery and fuel cell; Types of fuel cell –AFC, SOFC, DMFC, PEMFC and microbial fuel cell, relative merits and demerits.

UNIT-2 **6L+0T+6P = 12 Hours**

APPLICATION OF FUEL CELL TECHNOLOGY:

Fuel cell usage for domestic power system, large scale power generation, automobile, space, economic and environmental analysis of usage of hydrogen and fuel cells; future trends in fuel cell technology; Hydrogen safety codes and standards.

PRACTICES:

- Measure the stack efficiency of fuel cell.
- Determine the load response of the fuel cell.

SKILLS:

- Understand the fundamental principles of photovoltaic cell and its applications.
- Design a suitable power PV system for specific application.
- Understand the basic principles of fuel cells and identify different areas of fuel cell technology.
- Find the application of fuel cells in day-to-day life.

COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to:

CO No.	Course Outcome	Blooms level	Module No.	Mapping with POs
1	Compare the performance of photovoltaic cells with different configurations.	Apply	1	1,2,3, 5
2	Design the Solar PV systems keeping in view the current research trends.	Analyse	1	1,2,3,5, 6,7
3	Evaluate the performance of fuel cells under different operating conditions.	Evaluate	2	1,2,3, 5
4	Identify fuel cell technology for a given application.	Evaluate	2	1,2,3,5, 6,7

TEXT BOOKS:

1. C.S. Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications'', Prentice Hall India, 3rd edition, 2009.
2. B. Sorenson, "Hydrogen and Fuel cell", Elsevier, Academic press, USA, 3rd edition, 2018.

REFERENCEBOOKS:

1. A. K. Mukerjee, N. Thakur, "Photovoltaic systems: analysis and design", PHI, 2011.
2. V Barbec, V. Dyakonov, J. Parisi, N. S. Saricifttci, "Organic photovoltaics: Concepts and Realization", Springer Verlag, 2003.
3. G. N. Tiwari, "Solar Energy: Fundamentals, Design, Modelling and Application", 2013.
4. Rececca L. Busby, "Hydrogen and Fuel cells: A comprehensive guide", PenWell Books, 2005.
5. R. O' Hayre, S. Cha, W. Colella, F. B. Prinz, "Fuel Cell fundamentals", 3rd edition, John Willey and Sons, New York, 2016.

22PY854 - PHYSICAL METHODS IN BIOLOGY

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Biomolecules, Crystal Physics and Radioactivity.

COURSE DESCRIPTION AND OBJECTIVES

This course is aimed at creating awareness on investigating structural details of biomolecules by applying various physical techniques like Spectroscopy, X-ray crystallography, Electrophoresis and Radioactive methods.

MODULE-1

UNIT-1 **10L +0T+10 P = 20 Hours**

SPECTROSCOPY:

UV & Visible absorption spectrophotometry: Lambert Beer's Law, molar extinction coefficient and its determination, instrumentation & applications; Fluorescence Spectroscopy: principles and applications, Polarization of light, Fluorescence studies of plane-polarized light; Other common spectroscopic techniques: Principles, use and interpretation of Optical Rotatory Dispersion (ORD), Circular Dichroism (CD).

UNIT-2 **8L +0T+8P = 16 Hours**

MACROMOLECULAR STRUCTURE DETERMINATION:

Introduction to X-ray Crystallography: basis of crystallography theory, symmetry, instrumentation and biological applications, macromolecular diffraction and methods of phase determination; Principles of magnetic resonance spectroscopy: Nuclear Magnetic Resonance (NMR) & Electron Spin Resonance (ESR) and biological applications, Relaxation studies.

PRACTICES:

- Computing the absorption coefficient of various biomaterials using UV &Visible spectroscopy.
- Analysing the structure of biomaterials using X-ray diffraction.

MODULE-2

UNIT-1 **10L+0T+10 P = 20 Hours**

ELECTROPHORESIS & RADIOACTIVE METHODS:

Electrophoresis: Behaviour of bio-macromolecules in electric fields, Types of electrophoresis, PAGE, Agarose Gel Electrophoresis, 2D Electrophoresis, Di-electrophoresis.

Radioactive methods: Radioactive isotopes, nature of radioactive decay, sample preparation and counting, G.M. and Scintillation counters, Precautions in radio isotope handling, Autoradiography and its biological applications.

UNIT-2 **6L+0T+6P =12 Hours**

MICROSCOPY:

Optical Microscope, Fluorescent Microscope, Confocal Microscope, Electron Microscope, Applications of each microscopic method.

PRACTICES:

- Analysing the structure and surface morphology of biomaterials using various microscopy studies.
- Analysing the surface morphology of biomaterials using SEM.

SKILLS:

- Able to compute the absorption coefficient for various biomaterials using absorption spectroscopy studies.
- Able to interpret the structure of various biomaterials using X-ray diffraction studies.
- Able to understand the nuclear spin and electron spin and there by interpreting the materials using NMR and ESR spectroscopy studies.
- Able to analyse the surface morphology of biomaterials using electron microscope studies.
- Able to analyse the structure and surface morphology of biomaterials using various microscopy studies.

COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to

CO NO	Course outcomes	Blooms level	Module no	Mapping with POs
1	Interpret data from various spectroscopic techniques for structural determination.	Apply	1	1,2,5
2	Identifying hydrodynamic methods for differentiating biological macromolecules.	Analyse	1	1,2,5
3	Compare migration of macromolecules during electrophoresis and usage of radioactive methods for biological applications.	Analyse	2	1,3,5
4	Evaluate the utility of different types of microscopy.	Evaluate	2	1,2,3,5

TEXT BOOKS:

1. Colin Banwell, Fundamentals of Molecular Spectroscopy, 4th edition, McGraw Hill, 2017.
2. Lakowicz, Joseph R, "Principles of Fluorescence Spectroscopy", Springer, 2006

REFERENCE BOOKS:

1. Bernard Valeur, Mario NunoBerberan-Santos, "Molecular Fluorescence: Principles and Applications", Wiley, 2012
2. Markus Sauer, Johan Hofkens Jörg Enderlein, "Handbook of Fluorescence Spectroscopy and Imaging: From Single Molecules to Ensembles", Wiley, 2011
3. Jeremy N. S. Evans, "Biomolecular NMR Spectroscopy", OUP Oxford, 1995
4. Govil G. &Hosur R. V, "NMR – Conformation of Biological Molecules", Springer- Verlag, 1982.
5. William W. Parson, "Modern Optical Spectroscopy: With Exercises and Examples from Biophysics and Biochemistry",2nd edition, Springer, 2015

22PY855-RENEWABLE ENERGY TECHNOLOGIES

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basics of Semiconductors and energy sources.

COURSE DESCRIPTION AND OBJECTIVES:

The aim of the course is to understand the importance of renewable energy as an alternative for the conventional energy sources. You will be able to gain knowledge on the various types of alternate renewable energy technologies such as solar energy, wind energy marine and geothermal technologies. The course will help you to understand the feasibility, advantages and disadvantages of alternate energy sources.

MODULE-1

UNIT-1 **8L+0T+8P= 16Hours**

INTRODUCTION TO RENEWABLE ENERGY:

Classification of energy sources, energy picture of India, electricity production by nonrenewable energy sources, need for energy harvesting, renewable energy sources, Photovoltaic Systems Connected to the Grid, Advantages and disadvantages of renewable energy sources.

UNIT-2 **8L+0T+8P= 16 Hours**

SOLAR ENERGY:

Photovoltaic Electricity Production, Photovoltaic conversion, I-V characteristics of a cell and conversion output, different types of solar cells, materials for solar cells, Advantages and disadvantages of solar energy technology.

WIND ENERGY:

Wind energy technology, principle and operation of wind turbine, different types of wind generators, Integration of Wind Turbine Generators in to the Grid, Advantages and disadvantages of solar energy technology.

PRACTICES:

- Preparation of a chart on available renewable energy sources.
- Determination of efficiency of solar cell.

MODULE-2

UNIT-1 **8L+0T+8P= 16 Hours**

OCEAN ENERGY TECHNOLOGY:

Marine Energy Resources, Conversion System, Electricity productivity from marine resources, Ocean wave generator systems, Tidal energy converters, Advantages and disadvantages of ocean energy technology.

UNIT-2 **8L+0T+8P= 16Hours**

HYBRID ENERGY TECHNOLOGIES:

Hydropower energy, Geothermal energy, Hybrid energy harvesting technologies, piezoelectric energy technology, triboelectric energy harvesting technology, Advantages and disadvantages of piezo and triboelectric energy harvesting technologies.

PRACTICES:

- Preparation of data on marine resources in India for electricity production.
- Comparative statement on Hybrid energy technologies of advantages and disadvantages.

SKILLS:

- The student must be able to understand the various types of renewable energy sources
- The student is able to assess the advantages and disadvantages of solar, wind and other technologies.
- Understand the concepts of marine and geothermal technologies and their advantages and disadvantages.

COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to

CO No.	Course Outcome	Blooms level	Module No.	Mapping with POs
1	Identify different energy harvesting technologies as renewable energy sources.	Apply	1	1,2,3, 12
2	Contrast solar energy harvesting and wind energy harvesting.	Analyse	1	1,2,3,10, 12
3	Illustrate the ocean energy technologies and identify advantages and disadvantages.	Analyse	2	1, 3, 4, 5, 12
4	Choose an efficient approach from hybrid energy harvesting systems.	Evaluate	2	1, 2, 3, 4, 10, 12

TEXT BOOKS:

1. Renewable Energies, Jean-Claude Sabonnadière, Wiley Education, 2009.
2. Renewable Energy Resources– John Twidell and Tony Weir, 3rd edition, Taylor and Francis, 2015.

REFERENCE BOOKS:

1. Renewable Energy Technology– Indu Shekhar Jha, 1st edition New Age International Publishers, 2018.
2. Renewable Energy Sources and Emerging Technologies, D P Kothari, PHI, 2011.
3. Triboelectric Nanogenerators, Z. L. Wang, Springer, 2016.

22PY856-SPINTRONICS

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Basic foundation in Mathematics, Magnetism, and Nanomaterials.

COURSE DESCRIPTION AND OBJECTIVES:

The purpose of this course is to present the principles and concepts of Spintronics. It enunciates the concurrent understanding of Magnetism and Nanomaterials in the perspective of Magnetic Sensors, NV-RAMs, and Quantum computing as relevant to an Engineer.

MODULE-1

UNIT-1 **10L+0T+10P=20Hours**

MAGNETIZATION IN MATERIALS AND NANOFABRICATION TECHNIQUES:

Introduction magnetism-. Magnetic moment, magnetic materials - Magnetic stable states, hysteresis - Coherent magnetization reversal1 - Magnetization dynamic Sandau-Lifshitz-Gilbert equation) - Super Para magnetism - Nanofabrication and characterization of magnetic nanostructures – Deposition techniques- Nanofabrication techniques, Spin-dependent transport.

UNIT-2 **6L+0T+6P=12Hours**

GMR, TMR, BMR, AND RELATED PHENOMENA:

Magneto resistive phenomena (GMR, TMR, AMR, BMR, SHE) - Spin transfer torque(STT) - Spin-orbit torque (SOT) - Magnetic field sensors - Movement detection - Molecular detection - Magnetic reading heads - Spin torque oscillators.

PRACTICES:

- Determination magnetic susceptibility of a given material in the magnetic field.
- Interpretation of images of micro and nanostructures obtained from AFM (Atomic Force Microscopy).
- The use of spintronics elements to achieve high-speed power control while reducing standby power/to reduce the write power of a non-volatile register.

MODULE-2

UNIT-1 **8L+0T+8P=16Hours**

FIELD-ASSISTED SPIN SWITCHING IN MAGNETIC RANDOM ACCESS MEMORY:

General equation of the oscillator - Steady state precession (IPP, OPP) - Vortex oscillator, Magnetic random access memories - Field-induced magnetization switching – MRAMs - Thermally assisted MRAMs - Spin Transfer Torque MRAMs (planar and perpendicular)

UNIT-2 **8L+0T+8P=16Hours**

MAGNETIZATION DYNAMICS DRIVEN BY SPIN-ORBIT TORQUES:

Spin-orbit torque devices - Magnetic domain wall motion in Nano stripes - Magnetization reversal in perpendicularly magnetized nano dots - Skyrmions in magnetic nanostructures.

PRACTICES:

- Determination of Hall coefficient of semiconductor.
- Synthesis and characterization of magnetic nanostructures.

SKILLS:

- Ability in the design of devices, and computing skills at a deep level.
- Students learn to get themselves organized in conducting Project works
- Perform the handling of the computer of data and its statistical analysis.
- Analyze future computing paradigms like Neuromorphic computing, probabilistic computing, and Combinatorial optimization.
- Fabricate spin-based devices, circuits utilizing the spin, novel architecture and algorithms, and understanding of the computing principle.
- Design of devices for microelectronics and Biotechnology.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No	Course Outcomes	Blooms Level	Module No	Mapping with POs
1	Apply the concepts of magnetic materials in the perspective of Engineering applications	Apply	1	1, 3, 5, 6, 7
2	Apply the Magneto resistive phenomena for applications in medicine and foster knowledge of magnetic sensors.	Apply	1	1, 3, 5, 6, 7
3	Recognize the importance of Magnetic random-access memories.	Analyse	2	1, 2, 4, 5, 6, 7, 9
4	Evaluate magnetic nanostructures.	Evaluate	2	1, 2, 4, 5, 6, 7, 9

TEXTBOOKS:

1. Marc Cahay and Supriyo Bandyopadhyay "Introduction to Spintronics", 2nd Edition, CRC Press, ISBN 9780367656447,2020.
2. Bernard Dieny, Ronald B. Goldfarb, Kyung-Jin Lee, "Introduction to magnetic random-access memory", Wiley-IEEE Press, ISBN: 978-1-119-07941-5,2016.

REFERENCE BOOKS:

1. Yongbing Xu and David D Awschalom "Handbook of Spintronics", Springer, ISBN: 978-94-007-6892-5,2016,
2. Xiaobin Wang, "Metallic Spintronic Devices (Devices, Circuits, and Systems)", ASIN: B00MMOJ3MI, CRC Press; 1st edition, 2014.
3. Yong S Joe and Eric R Hedin "Spintronics in Nanoscale Devices",1stEdition, Jenny Stanford Publishing, ISBN9780429073656,2013.
4. J.M.D. Coey, "Magnetism, and Magnetic Materials, Cambridge University Press", ISBN: 9780511845000,2012.
5. Patrizio Graziosi, "Material Engineering in Hybrid Spintronic Devices", Lambert Academic Publishing, ISBN: 9783838383347, 3838383346,2010.

22PY857-THIN FILM TECHNOLOGY

Hours per week:

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Fundamentals of Physics.

COURSE DESCRIPTION AND OBJECTIVES:

This course aims at developing comprehensive understanding on thin film deposition principles and techniques. You will gain a fundamental view on the thin film growth process as well as the microstructure that has been developed during the deposition process. The course will help you develop the skills to design thin film systems and select appropriate deposition techniques based upon materials composition, microstructures and properties.

MODULE – 1

UNIT-1 **10L+0T+10P= 20Hours**

INTRODUCTION TO THIN FILMS, VACUUM PUMPS AND MEASUREMENT OF LOW PRESSURE:

Introduction: Basics of thin films, Importance of thin films in devices and modern technology.

Vacuum pumps: Principles of pumping, Mechanical oil sealed rotary pump, Diffusion pump, Cryogenic pumps.

Measurement of low pressure: Manometer, Mac Leod gauge, radiometer gauge, Thermal conductivity gauges - Pirani gauge, Thermocouple gauge, Semiconductor gauge, Ionization gauges - Hot-Cathode ionization gauge, Cold –cathode ionization gauge (Penning gauge).

UNIT-2 **6L+0T+6P= 12 Hours**

NUCLEATION AND FILM GROWTH:

Nucleation and film growth: Thermodynamics of nucleation, nucleation theories: Capillarity model, Atomistic or statistical model, Comparison of two models of Nucleation, Film growth.

Thickness measurement: Microbalance technique, crystal oscillator technique, Optical methods - Photometric method, Ellipsometry and Interferometry.

PRACTICES:

- Discuss the differences and similarities between different vacuum pumps.
- Working and Usage of various pressure gauges to measure the pressure of media in a vacuum system.
- Evaluate and use models for nucleating and growth of thin films.

MODULE-2

UNIT-1 **10L+0T+10P= 20 Hours**

THIN FILM DEPOSITION AND CHARACTERIZATION TECHNIQUES:

Physical methods: Ball milling, Thermal evaporation, Flash evaporation, Activated Reactive Evaporation (ARE), Electron beam (EB) evaporation, DC Magnetron sputtering, RF Magnetron sputtering, Pulsed laser deposition, Molecular Beam Epitaxy, Lithography, Electron Beam Lithography, Nanoimprint Lithography, Dip Pen Nanolithography.

Chemical methods: Chemical vapour deposition, Vapour phase epitaxy, Spray pyrolysis, Spin coating, Sol-gel process, Electrochemical deposition.

UNIT-2 **6L+0T+6P= 12 Hours**

CHARACTERIZATION TECHNIQUES AND APPLICATIONS OF THIN FILM TECHNOLOGY:

Characterization Techniques: X-ray diffraction, Scanning Electron Microscopy, Atomic Force microscopy, Four Probe Resistivity and UV-VIS spectroscopy.

Applications of thin film technology: Thin film resistors, Thin film capacitors, Thin film solar cells, Gas sensors, Thin film solid state micro batteries, Micro and opto electronic devices, Chromogenic devices.

PRACTICES:

- Identify the most important growth conditions for a material.
- Compare available deposition techniques and select the most suitable one.
- Asses the relation between deposition technique, film structure, and film properties.

SKILLS:

- Able to understand the basic concepts of thin films and their applications in modern society.
- Able to know the designs, working processes and functioning of various components in thin film deposition systems.
- Able to understand the working processes of various thin film deposition methods and characterization techniques

COURSE OUTCOMES:

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

CO No.	Course Outcome	Blooms level	Module No.	Mapping with POs
1	Compare the design, principle of working for the various components of thin film deposition systems.	Apply	1	1, 2, 3, 5, 12
2	Analyse the mechanism of nucleation and growth process of thin films obtained from various deposition techniques.	Analyse	1	1, 2, 3, 4, 12
3	Predict the process of depositing the thin films by various physical and chemical vapor deposition techniques	Evaluate	2	1, 3, 5, 12
4	Compute the structural, morphological, electrical and optical properties of deposited thin films for various applications	Evaluate	2	1, 3, 4, 12

TEXT BOOKS:

1. Roth, "Vacuum Technology", North Holland publishing company, USA, 3rd edition, 1990.
2. K.L. Chopra, "Thin Film Phenomena", McGraw-Hill, New York, 1969.

REFERENCES:

1. Donald. L. Smith, "Thin Film Deposition (Principles and Practice)", McGraw-Hill, 1995.

2. Ludmila Eckertova, “Physics of Thin Films”, Plenum press, New York 1977.
3. Guozhong Cao, “Nanostructures& Nanomaterials: Synthesis, Properties & Applications”, Imperial College Press, 2004.

22RA851-AUTONOMOUS AERIAL VEHICLES

Hours per week

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Fundamental physics, Mathematics

COURSE DESCRIPTION AND OBJECTIVES:

The course deals with the fundamentals of unmanned aerial vehicles, concept of pay load on the vehicles for several applications in defense, agricultural etc., basics related to launching and navigation of the vehicles. The objective of the course is to acquire the knowledge of basic UAV systems and ground control station to launch and navigate them.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

Introduction to UAV: Difference between aircraft and UAV - Parts and functions of Fixed, Rotorcraft and flapping wing UAV, types of UAV, Characteristics of Multi rotor vehicle.

UNIT-2 **10L+10T+0P=20 Hours**

Payloads for UAV: Payloads – Classification of Payloads – camera – sensors – radars – various measuring devices – classification of payload based on applications.

MODULE-2

UNIT-1 **6L+6T+0P=12 Hours**

Launch, Navigation & Recovery: Launching systems - UAV Launch Methods for Fixed-Wing Vehicles - Vertical Takeoff and Landing UAV Launch - Recovery systems.

UNIT-2 **10L+10T+0P=20 Hours**

Ground Control Station: Navigation - UAV Guidance - communication systems - Ground control station – Telemetry - UAS future.

PRACTICES:

- Forces and moment estimation of fixed wing vehicle using sub sonic wind tunnels.
- Pressure distribution measurement over various airfoil sections.
- Thrust calculations for various types of propellers.
- Construction of various fixed wings – straight and dihedral.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	**Apply** the basic concepts of UAV systems	Apply	1	1, 2
2	**Explain** the basic aerodynamics, performance, stability and control required for UAV	Evaluate	1	1, 2, 3

3	**Estimate** the payloads on different vehicles	Analyze	2	1, 2, 3
4	**Interpret** the data during launching, navigating, and recovery of UAV systems	Evaluate	2	1, 2,9

TEXT BOOKS:

1. Paul Gerin Fahlstrom, Thomas J. Gleason, Introduction to UAV systems, Wiley Publication, 4th Edition, 2012.
2. Landen rosen, Unmanned Aerial vehicle, Alpha editions, ISBN13: 9789385505034.

REFERENCE BOOKS:

1. Valavanis, Kimon P., Unmanned Aerial Vehicles, Springer, 1st Edition, 2011.
2. Unmanned Aerial Vehicles: DOD's Acquisition Efforts, Alpha Editions, ISBN13:9781297017544.
3. Valavanis, K., Vachtsevanos, George J., Handbook of Unmanned Aerial Vehicles, , Springer, 1st Edition, 2015.

Image Source Link: https://www.electronicproducts.com/wp-content/uploads/electromechanical-components-motors-and-controllers-analog-devices-unmanned-aerial-vehicles.png

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22RA852-CONDITION MONITORING OF ENGINEERING SYSTEMS

Hours per week

L	T	P	C
2	2	-	3

PREREQUISITE KNOWLEDGE: Sensors and Instruments

COURSE DESCRIPTION AND OBJECTIVES:

To provide a basic understanding with case studies on different condition monitoring techniques and apply them for inspecting machines in accordance with industry standards. To provide knowledge and enrich ideas about the conventional NDT techniques.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

Introduction: System failure, component failure, failure decisions, failure classifications, types of failure, failure investigations, causes of failure, Methods of maintenance – condition based maintenance, preventive maintenance, predictive maintenance, proactive maintenance. Need and importance of condition monitoring, the decision to monitor, common monitoring techniques, online/off-line monitoring, commonly measured operating characteristics.

UNIT-2 **10L+10T+0P=20 Hours**

Signal Processing: Time domain analysis, frequency domain analysis – FFT and power spectrum, time – frequency domain – STFT, Spectrogram, Periodogram. Envelope Analysis, Cepstrum Analysis.

PRACTICES:

- Time domain Analysis.
- Frequency domain Analysis.
- Time – Frequency Analysis.
- Envelope Analysis.

MODULE-2

UNIT-1 **6L+6T+0P=12 Hours**

Correcting Faults: Common Faults observed in Rotating Machines, Vibration Severity Charts, FFT Analyzer, Counter measures to reduce vibrations – balancing, alignment, resonance vibration control.

UNIT-2 **10L+10T+0P=20 Hours**

Introduction, Need for Machine learning, Trend Analysis – regression and forecasting, Fault Classification – Discriminant Analysis, SVM, ANN.

COURSE OUTCOMES:

Upon successful completion of this course student will be able to:

No.	Course Outcome	Blooms Level	Module No.	PO
1	Calibrate the instrument and inspect for in-service damage in the components.	Apply	1	1,5,9,10,12
2	Differentiate various defect types and select the appropriate monitoring methods for better evaluation.	Apply	1	1,2,3,5,9,10,12
3	Communicate their conclusions clearly to specialist and non-specialist audiences.	Analyze	2	1,2,4,5,9,10,12
4	Evaluation of the results for failure analysis of the components	Evaluate	2	1,5,9,10,11,12

SKILLS:

- Explain the concepts of Condition Monitoring.
- Propose suitable Condition Monitoring Technique for fault Identification.
- Suggest suitable analysis for fault detection.

TEXT BOOKS:

1. Collacott R.A. "Mechanical Fault Diagnosis and Condition Monitoring", Chapman and Hall,London, 2nd Edition, 2007.
2. Randall R.B., "Vibration based Condition Monitoring: Industrial, Aerospace and Automotive Applications", Wiley Sons & Co., 1st Edition, 2010.

REFERENCE BOOKS:

1. Mohanty. A.R. "Machinery Conditon Monitoring: Principles and Practices", CRC Press Book, 1st Edition, 2014.
2. Rao B.K.N, "Hand Book of Condition Monitoring", Elsevier Science & Technology, Oxford, U.K, 1st Edition, 1996.
3. Rao J.S., "Vibratory Condition Monitoring of Machines", Narosa, 1st Edition, 2000.

Image Source Link: https://cdn.automationforum.co/uploads/2022/09/Condition-Monitoring-System-1.jpg

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22RA853-ROBOTICS FOR ENGINEERS

Hours per week

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Matrix Operations

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the basic concepts and topics to impart knowledge on Robots and their anatomy, kinematics, Dynamics and Applications. The main objective of this course is to make students familiarize about the concepts of Robotics as an introductory course.

MODULE-1

UNIT-1 **6L+6T+0P=12 Hours**

Introduction, Robot Anatomy – Coordinate System, Matrix Transformations, Kinematic Analysis

UNIT-2 **10L+10T+0P=20Hours**

Kinematic Analysis of SCARA Robot, Articulated Arm.

MODULE-2

UNIT-1 **6L+6T+0P=12 Hours**

Robot Applications: Robot Cell Layouts, Multiple Robots and Machine Interference, Work Cell Control, Economic Analysis.

UNIT-2 **10L+10T+0P=20 Hours**

Robot Cycle Time Analysis, Error Detection and Recovery, Payback Method, Equivalent Uniform Annual Cost Method, Return on Investment Method.

PRACTICES:

- Motion Analysis of Robot using C/MATLAB.
- Evaluation of Joint angles of Robot by Inverse Kinematics using C/MATLAB.
- Economic Analysis of Robot Cell using C/MATLAB.
- Error Detection and Recovery in Robot Cell using C/MATLAB.

COURSE OUTCOMES:

Upon successful completion of this course student will be able to:

No.	Course Outcome	Blooms Level	Module No.	PO
1	Distinguish robots based on their anatomy.	Apply	1	1,5,9,10,12
2	Recommend type of robot based on end application.	Apply	2	1,5,9,10,11,12
3	Perform kinematic and Dynamic analysis of robots.	Evaluate	1	1,2,3,5,9,10,12

4	Demonstrate the operation of grippers used in industries.	Analyze	2	1,2,4,5,9,10,12

SKILLS:

- Explain the basics involved in robots.
- Apply matrix transformation analysis for kinematic modeling.
- Suggest suitable type of robot based on end application.

TEXT BOOKS:

1. Peter Corke,"Robotics and Control: Fundamental Algorithms in MATLAB", Springer, 2nd Edition, 2021.
2. Nicolas Odrey, Mitchell Weiss, Mikell Groover, Roger Nagel, Ashish Dutta, "Industrial Robotics -Technology, Programming and Applications", McGraw Hill Publications, 2nd Edition, 2017.

REFERENCE BOOKS:

1. Laura Menini, Corrado Possieri, Antonio Tornambe, "Algebraic Geometry for Robotics and Control Theory", World Scientific Publishing Europe Ltd. 1st Edition, 2021.
2. Joseph Duffy, "Statics and Kinematics with Applications to Robotics Cambridge University Press,", 1st Edition Reprint, 2009.
3. K. S. Fu, Ralph Gonzalez, C.S.G. Lee, "Robotics", McGraw Hill Publications, Indian Edition, 2017.

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22TP851 - ECONOMIC AND SOCIAL DEVELOPMENT OF INDIA

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: High school level social studies.

COURSE DESCRIPTION & OBJECTIVES:

This course introduces basic understanding of Indian economy. The course objective is to make students to understand the role of government in managing economy and gives basic knowledge about different sectors of the economy besides equipping them the tools to analyse the state of current economy.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

INTRODUCTION OF INDIAN ECONOMY:

Structure of the Economy: Basic Concepts, Sources of Revenue and classification of expenditures of Union Government, Fiscal indicators, Structure of the Economy, Recent trends in the National Income, Performance on the social front.

UNIT-2 **8L+8T+0P=16 Hours**

ECONOMIC REFORMS:

LPG Policies and industrial policy: Transition from Centralized Planning to Indicative Planning, LPG Policies, Globalization and its discontents, WTO, TRIPS, TRIMS, GATS, Strategy of Industrialization, Special Economic Zones, FDI Policy, Multi-National Companies and their importance, Rise of Corporate power in India, Privatization and Disinvestment policies, Infrastructure policies.

PRACTICES:

- Evaluating the concept of budget and budgeting through newspaper articles and budget speech.
- Do a comparative study of China and India regarding industrialization strategy.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

POVERTY:

Poverty Alleviation Programs: Measures of Poverty and inequality and trends therein, Anti-Poverty Programmers -, Public Distribution System, Wage Employment Programmes, Concepts of Social justice and Inclusive growth and their components.

UNIT-2 **8L+8T+0P=16 Hours**

ECONOMIC ISSUES:

Agrarian Issues: Agrarian Structure, Land Reforms, Farm subsidies, Agricultural Price Policies, Food Security, Agrarian Crisis and Farmer suicides, WTO and Indian Agriculture.

PRACTICES:

- Use research methods such as preparation of questionnaires, conducting of surveys, and participant observation to understand Agrarian distress around your locality.
- Through group discussion find out effective ways to reduce poverty in India.

SKILLS:

- Basic understanding about economics.
- make the student aware about the role of government in Indian economy.
- to have an understanding about different sector in Indian economy.
- To have knowledge about the welfare programmers introduce by government.
- To analysis social problems through the lens of economics.

COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with PO's
1	Analyse the evolution of Indian Economy.	Analyse	1	6
2	Critically examine the impact of globalization on Indian economy. Evaluate industrial policy and industrialization in India.	Analyze	1	6
3	Evaluate the agrarian structure, agriculture and impact of international organizations on Indian agriculture.	Evaluate	2	6
4	Examine poverty in India and assess measures taken by Government of India to alleviate poverty.	Evaluate	2	6

TEXTBOOKS:

1. Ramesh Singh, "Indian Economy for Civil Services Examinations", Mc Graw Hill, 2014.

REFERENCE BOOKS:

1. Dutt and Sundaram, "Indian Economy", S. Chand & Co., 2014.
2. Misra & Puri, "Indian Economy", Himalaya Publications. 2014.
3. Joseph E. Stigltz, "Globalization and its Discontents" W.W Norton, 2003.
4. Jean Dreze and Amartya Sen, "An Uncertain Glory: India and its Contradictions", Penguin, 2014.

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22TP852- MODERN INDIAN HISTORY AND INDIAN CULTURE

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: High school level history and social studies.

COURSE DESCRIPTION AND OBJECTIVE:

This course introduces a basic understanding of Indian culture and history. The course objective is to describe various stages of Indian history and their importance, understand the importance of different historical events in shaping Indian history, and enable the students to understand the relevance of Indian history and make them much more socio-conscious in society.

MODULE – 1

UNIT-1 **8L+8T+0P =16 Hours**

ADVENT OF EUROPEANS IN INDIA AND CONSOLIDATION OF BRITISH POWER IN INDIA:

European Settlements: The Early European Settlements; the Portuguese and the Dutch; the English and the French East India Companies; The British-French struggle for supremacy; Carnatic Wars; Bengal -The conflict between the English and the Nawabs of Bengal; Siraj and the English; The Battle of Plassey; Significance of Plassey, Bengal – Mir Jafar and Mir Kasim; The Battle of Buxar; Mysore; Anglo-Mysore Wars; The Marathas; The three Anglo-Maratha Wars; Punjab; Anglo-Sikh Wars; Administrative Policies; Policy of Ring-fence, Subsidiary alliance, Doctrine of lapse.

UNIT-2 **8L+8T+0P =16 Hours**

BRITISH ADMINISTRATION SOCIAL REFORMS AND 1857 REVOLT:

Administrative Policies: Charter Acts and Council Acts; Economic policies of British Colonial Rule: Land revenue settlements, Commercialization of agriculture, Drain of wealth, Deindustrialization; Social and educational reform measures; Abolition of sati, Measures against Human sacrifice and slavery, attempts to end religious and caste discrimination, Education policy; Socio-cultural awakening in India: Causes and Impact; Major reform movements, significance and limitations of reform movements; Major resistance movements and the revolt of 1857.

PRACTICES:

- Map pointing to locate the rule of different foreign countries.
- Find the popular struggles of Indians and also popular rules during the early stage of modern Indian History.
- The effective administrative policies of the Britishers, which resulted in the social, economic, political, and cultural awakening among Indians.

MODULE – 2

UNIT-1 **8L+8T+0P =16 Hours**

INDIAN NATIONAL MOVEMENT:

Early Indian nationalism: Politics of association before 1885 and significance, Indian National Congress, Safety Valve Theory; Moderate Phase (1885-1905) and Extremist Phase (1905-1909);

Swadeshi and Boycott Movement: Reasons, Spread of the Movement, People's Response and Government Response, Partition of Bengal; Evaluation of Swadeshi Movement; The Surat Split; Morley Minto Reforms; First World War and Indian Response; Home Rule League; Lucknow Session of INC; Other strands of national movements; revolutionary and left movements; Montagu-Chelmsford Reforms and Government of India Act 1919.

UNIT-2 **8L+8T+0P =16 Hours**

EMERGENCE OF GANDHI, TOWARDS PARTITION AND INDEPENDENCE:

The emergence of Gandhi: Philosophy and ideas of Gandhi, Early Activism, Rowlatt Act; Non-Cooperation Movement: Reasons, Spread of the Movement, People's Response and Government Responses, Evaluation; Swarajists and Socialist Ideas; Simon Commission and Nehru Report; The run-up to Civil Disobedience Movement; Civil Disobedience and Salt Satyagraha; Reasons, Spread of the Movement, People's Response Government Response and Evaluation; Karachi Session Round Table Conferences; 2nd Phase of CDM; Communal Award and Poona Pact; Towards Freedom and partition: Tripuri Session; Gandhi- Bose Ideological differences; Nationalist Response to War-August Offer, Individual Satyagrahas; Cripps Mission; Quit India Movement: Reasons, Spread of Movement, Peoples Response and Government Response; Rajagopalachari Formula, Wavell-plan, Cabinet Mission, Atlee's Statement and Mountbatten Plan, India Independence Act; Communalism and two nation theory, Partition; consequences and rehabilitation after partition; Indian Heritage and Culture: Culture: Meaning, Components, Difference between Culture and Civilization; Characteristics of Indian Culture; Visual Arts- Art, Sculpture, and Architecture (UNESCO Heritage Sites); Performing Arts: Music and Dance and Literature.

PRACTICES:

- Reasons for the Indian National Movement, and the subsequent movements launched by freedom fighters.
- Chronological order of the series of acts enacted by the British Parliament to govern India with popular heads in different time periods.
- The popular Indian Art, Music, Architecture, and Literature.

SKILLS:

- Analyse the importance of the national movement.
- Compare different perspectives to understand historical events.
- Identify major turn of events and evaluate the historical development of Indian society.

COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to:

CO No.	Cos	Blooms Level	Module No.	Mapping with POs
1	Critically analyze modern Indian history and culture.	Analyze	1	6
2	Analyse critically the effects of colonization on India.	Analyse	1	6

3	Have a critical appreciation of values that inspired the Indian National Movement.	Analyse	2	6
4	Appreciate the rich cultural heritage of our country.	Evaluate	2	6

TEXTBOOKS

1. Bipin Chandra, "India's Struggle for Independence," Penguin, Reprint Edition 2016.
2. Sekhar Bandyopadhyay, "From Plassey to Partition and After: A History of Modern India," Orient Blackswan Private Limited Reprint Edition 2014.

REFERENCES BOOKS

1. Sumit Sarkar, "Modern India1885-1947," Pearson Education India; 1st Edition 2014.
2. A.L Basham, "A Cultural History of India", (ed) Oxford, New Edition 1983.
3. Themes in Indian History-III, NCERT, Reprint Edition 2019.
4. An Introduction to Indian Art part-1 NCERT, Reprint Edition 2019.

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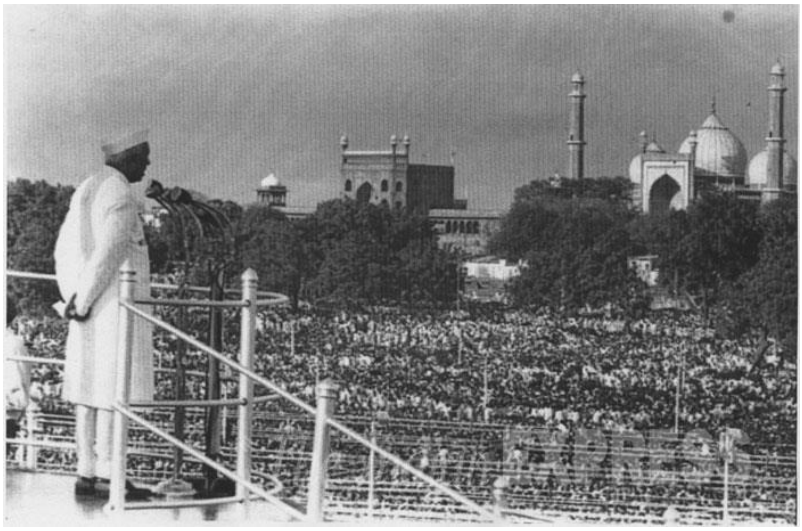
https://en.wikipedia.org/wiki/History_of_India_%281947%E2%80%93present%29#/media/File:PM_Nehru_addresses_the_nation_from_the_Red_Fort_on_15_August_1947.jpg



22TP853-POLITY AND GOVERNANCE IN INDIA

Hours per week:

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Constitution of India.

COURSE DESCRIPTION AND OBJECTIVES:

This course introduces a basic understanding of Indian polity and the constitution. The course objective is to make students understand the functioning of government at the centre, state, and local levels as outlined in the constitution. This course also provides basic knowledge about the fundamental rights and fundamental duties as espoused in the constitution, information about various constitutional bodies, and knowledge about elections and democracy at work.

MODULE-1

UNIT-1 **8L+8T+0P=16 Hours**

SALIENT FEATURES OF CONSITUTION:

History and Salient Features of the Constitution: Historical inheritance and institutional legacies; Making of India's Constitution: Major features of the Constitution; Philosophy of Indian Constitution: Preamble, Fundamental Rights, Directive Principles of State Policies, and Fundamental Duties; Emergency and Constitution Amendment Procedure and Basic Structure.

UNIT-2 **8L+8T+0P=16 Hours**

ORGANS OF THE GOVERNMENT:

Legislature: Structure, Functions, Power and Processes of Parliament and State Legislature. And Parliamentary Committees; Decline of legislature- decline of legislature – Delegated Legislation – Legislative and Judicial control over the delegated; **Executive:** President: Election, Powers and Functions; Prime Minister and Council of Ministers: Relationship between executive and legislature: accountability, collective responsibility; Growing importance of the Cabinet; Governor: Appointment, Powers and Functions; Chief Ministers; Relationship between governor and chief minister. Federalism: Major issues; Centre-State relations: Legislative, Executive and Financial; **Judiciary**: Structure, Functions, Powers of Indian Judiciary (Supreme Court, High Court and Subordinate courts)Judicial independence and review; Judicial activism and overreach.

PRACTICES:

- Enactment of Constituent Assembly debates to further understand the rationale for the provisions of the constitution.
- Exercise comparing Indian parliamentary system with other types of governments across the world.

MODULE-2

UNIT-1 **8L+8T+0P=16 Hours**

ELECTIONS AND PARTY SYSTEM AND LOCAL SELF GOVERNMENT:

Election Commission of India: Structure, Functions and Powers; Representation of Peoples Act; National and regional parties; Transformation of the party system: Coalition governments and

coalition politics at the national and state level; Local Governance: 73rd and 74th Constitutional Amendment Acts.

UNIT-2 **8L+8T+0P=16 Hours**

INSTITUTIONS OF GOVERNANCE, GOOD GOVERNANCE, AND WELFARE OF THE MINORITIES:

Comptroller and Auditor General; Finance Commission; UPSC, Inter-State Council; National Human Rights Commission; Central Information Commission, Central Vigilance Commission; CBI, Lok Pal and Lokayukta; Good Governance: Transparency, Accountability and Responsibility; e-governance- application; Provisions for scheduled castes, Tribes and Minorities; Reservations for SC, ST and Backward classes; Prevention of SC and ST Atrocities Act; National and State SC and ST Commission; Women's Commission.

PRACTICES:

- Browse various government/administration departments and identify their mission.
- Collect news published in the local papers about panchayats in the nearby areas.

SKILLS:

- Analyze political events in the country.
- Study and compare various contemporary governments and constitutions.
- Analyze the functions of the government authorities.
- Ability to carry on meaningful and educated conversations about the current political scenario.
- Ability to clearly articulate ideas in writing as well as orally on various political issues.

COURSE OUTCOMES:

Upon successful completion of the course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with PO's
1	Analyse critically the major articles and provisions of Indian constitution.	Analyse	1	6
2	Critically examine relationship between rights and duties.	Analyse	1	6
3	Analyse functioning of executive, legislative and Judiciary in a democracy and their role in democracy.	Analyse	2	6
4	Have a comparative picture of Indian Constitution vis-a-vis constitution of the other democracies of the world.	Evaluate	2	6
5	Critically examine the problems of administration in India and provide solutions.	Evaluate	2	6

TEXTBOOKS:

1. PM Bhakshi, “Constitution of India”, 15th edition, Universal Law Publishing, 2018.

REFERENCE BOOKS:

1. Subhash Kashyap, “Our Constitution” 2nd edition, National Book Trust, India, 2011.
2. Subhash Kashyap, “Our Parliament” 1st edition, National Book Trust, India, 2011.
3. Mohit Bhattacharya, “New Horizons of Public Administration”, 7th edition, Jawahar Publishers and Distributors, 2008.

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22TT851 - FASHION THEORY

Hours per week:

L	T	P	C
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basic knowledge of fashion trends

COURSE DESCRIPTION AND OBJECTIVES:

This course offers introduction to fashion, art and design, consists of basic definition of fashion, classification and its type, types of design, elements of designing, traditional textiles of India and role of garment accessories. The objective of this course is to provide insights in to fundamentals of fashion theory, designing and technological aspects of fashion.

MODULE 1

UNIT-1 **8L+0T+0P=8 Hours**

INTRODUCTION TO FASHION DESIGN:

Definition of fashion design, Costume and clothing, Origin and history; Importance of clothing, factors to be considered in the selection of clothing; Evolution of dress from paintings, cuttings, sculpture and wood carvings. Classification and types of fashion; Factors effecting fashion, business of fashion, theories of fashion; Study of leading fashion designers; French, Italian, American, Indian and English.

Definition of fashion designing: Concepts of design, types of design, elements of design, principle of designing, role of fashion designers.

UNIT-2 **8L+16T+0P=24 Hours**

COSTUMES OF ANCIENT CIVILIZATIONS:

Costumes of ancient civilizations: Traditional costumes of different states of India; Costumes of ancient civilizations, Egypt, Greek, Roman, English, French empires during Renaissance 1500 – 1600 AD; Overview of costumes of Pakistan, Sri Lanka, Burma, China, Japan and Africa.

PRACTICES:

- Case studies on History of embroidered,
- Case studies on hand-woven, dyed, printed and painted textiles of India;
- Case studies on Floor coverings, carpets and durries;
- Case studies on Colored textiles, bandhani, patola, ikkat, pocchampalli;
- Case studies on Woven textiles brocades, jamavar, paithani, jamdani, chanderi, maheshwari, kanjivaram, kota, baluchari, dacca muslin, himrus and amrus.
- Case studies on Printed textiles
- Case studies on Painted textiles; Kalamkari; Shawls of kashmir.

MODULE 2

UNIT - 1 **8L+0T+0P=8 Hours**

GARMENT ACCESSORIES:

Introduction to fashion accessories, classification of various accessories; Selection of materials, design, functional and aesthetic performance and their advantages; Ribbons, Braids, Laces,

Appliqués, Buttons, Zippers, Snap fasteners, Hooks and eyes, Hook and loop tape; Eyelets, Neck tie, Scarves, Stoles, Umbrella, Socks, Stockings, Veils.

.

UNIT - 2 **8L+16T+0P=24 Hours**

LEATHER ACCESSORIES:

Leather accessories: Selection of materials, design, functional and aesthetic performance and their advantages; Various styles of footwear, belts, gloves, hand bags, hats, wallets, and other personal leather goods; Concepts of pattern making techniques and the production process of these accessories

PRACTICES:

- case studies on Selection of materials
- case studies on aesthetic performance
- case studies on various styles: Pendants, waist bands, wrist bands, necklaces, head bands, bows, sunglass, wrist watches, rings, ear rings, bangles, bracelets and anklets.

SKILLS:

- Trace origin of any clothing and costume.
- Identify the nature of fashion for the leading fashion brands.
- Give the styling techniques and material requirement for the traditional costume.
- Identify the different textile techniques of traditional India.
- Select material for garment accessories based on aesthetic and Functional requirements.
- Select material for aesthetic and functional requirements.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply Theoretical aspects of fashion, design and technology with respect to various selection factors.	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Review the evolution of clothing and interpretation of theories relating to fashion.	Apply	1, 2	1, 2, 5, 9, 10
3	Illustrate different clothing of Indian states and civilizations.	Analyse	1, 2	1, 2, 3, 5, 9, 10
4	Design and apply various fashion accessories for a specific garment style.	Analyse	2	1, 2, 5, 9, 10, 12

TEXT BOOKS:

1. G. Russel, B. Nicholas, “Traditional Indian Textiles”, Thames and Hudson, London, 1991.
2. J. Peacock, “Fashion Accessories – The Complete 20th Century Source Book”, Thames and Hudson Publication, 2000.

REFERENCE BOOKS:

1. G.S Churye, “Indian Costume”, Prakashan Pvt. Ltd., Bombay, 1995.
2. R. Bhargav, “Design Ideas and Accessories” Jain Publications Pvt. Ltd., 2005.
3. P. Tortora, “Encyclopedia of Fashion Accessories”, Om Books Publication, 2003.
4. Elaine Stone, “Fashion Merchandising – An Introduction”, 5th edition, McGraw-Hill, 1990.

Image source :

https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcRk_cGR1X3sdBFVFubnrXu1qcrb2IKj83M_gcnqohsPEwzwjMaj3EgrFBGOvH9xk_XlKhs&usqp=CAU

Image file name: 22TT851 - FASHION THEORY

22TT852 - COSTING OF TEXTILE AND APPAREL PRODUCTION

Hours per week:

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basic knowledge of textile costing

COURSE DESCRIPTION AND OBJECTIVES:

This course offers fundamental concepts of costing and its various types of costing used in apparel industry. It discusses about factors that determine the price of garment and its components, different types and functions of packing and labeling cost. Objective of this course is to impart knowledge on costing and documents connected to exports and international codes for products and services.

MODULE 1

UNIT - 1 **8L+0T+0P=8 Hours**

INTRODUCTION:

Introduction – Cost, principles of cost; Types of cost - Fixed cost, variable cost, semi variable cost, conversion cost, differential cost; Elements of cost, direct material cost, direct expenses, direct wages, Indirect materials, Indirect expenses, Indirect labor; Overheads - Production overhead, administrative overhead, selling overhead, distribution overhead.

UNIT - 2 **8L+16T+0P=24 Hours**

FACTORS INFLUENCING THE COSTING PROCESS:

Factors influencing the costing process - Fabric cost, unit of measurement (UoM), fabric minimum order quantity (MOQ), order quantity.

PRACTICES:

- Yarn cost calculation; Process cost calculation (Weaving/ knitting);
- Loom production cost, calculation of weaving cost, pick cost.
- Pre-treatment, dyeing, printing and finishing cost calculations;
- Garment Screen printing types and costs;
- Woven and knitted fabric cost calculations.

MODULE 2

UNIT - 1 **8L+0T+0P=08 Hours**

COST CALCULATION IN APPAREL PRODUCTION:

Cost calculation in apparel production departments: Cutting department costs; Sewing department costs; Cost per minute of a sewing line; Costing of materials labor; Overheads in making of garments; Embroidery cost, factors affecting cost of embroidery; Trimming and checking department cost; Packing department costs, poly bag consumption calculations, carton box; Calculation of shipping and forwarding cost.

Factors influencing the cost of shipment - Mode of shipment, volume or size of the order, type of assortment, destination country, government rules and regulations.

UNIT - 2 **8L+16T+0P=24 Hours**

OVERALL APPAREL MANUFACTURING COST:

Calculation of overall apparel manufacturing cost - (Cut – Make – Trim/Pack and Shipping), sample cost sheet; Packing and labelling cost - Different types and functions; Note on sustainable packing trims; Uses of brand and size label; Cost of technical trims and packing trims - Thread, button, zippers, interlining; Shipment cost; Cost calculation of ladies, men and children's wear; Woven and knitted; Simple problems.

PRACTICES:

Case studies on Terms of payment in exports –

- Advance payment, letter of credit (L/C),
- documents against acceptance (DA),
- documents against payment (DAP);
- A note on L/C operation flow, types of L/C;
- Delivery terms used in general export business;
- Note on INCOTERMS, dollar planning, dollar hedging.

SKILLS:

- Trace and analyze the steps involved in costing of garments and apparel production.
- Analysis of types of cost for making a garment.
- Calculate cost incurred in exporting to various countries.
- Identify the characteristics and components of costing and apparel production.
- Analyze the process of costing and apparel production.
- Identify the characteristics and components of costing and apparel production

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes

COs	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Costing components and their functions, Examining their role in costing and apparel production.	Apply	1, 2	1, 2, 5, 9, 10
2	Assess costing for different materials, process and products.	Apply	1, 2	1, 2, 3, 5, 9, 10
3	Analyze the elements of costing and apparel production.	Analyse	1	1, 2, 4, 5, 9, 10, 12
4	Examines, evaluate costing for different Trims, CMT Costs.	Analyse	2	1, 2, 5, 9, 10, 12
5	Demonstrating the effect on cost by varying the payment terms, dollar hedging in various product	Evaluate	1, 2	1, 2, 3, 4, 5, 9, 10, 12

TEXT BOOK:

1. R. Rathinamoorthy and R. Surjit, “Apparel Merchandising”, 1st edition, Woodhead Publishing India Pvt. Ltd, 2018.

REFERENCE BOOKS:

1. Richord D. Irwin Icn,” Principles of cost Accounting: Managerial Applications” Revised by Gayle Rayburn1983.
2. Sultan Chand & sons “Management Accounting” New Delhi, 2nd edition 1998.
3. David J. Tyler., “Materials Management in Clothing Production “, Blackwell Scientific Publications.

Image source :

https://i0.wp.com/textiletutorials.com/wp-content/uploads/2017/05/Cost-or-costing-in-textile-and-apparel-business-min.jpg?fit=600%2C319&ssl=1

Stitching Cost for Different Apparel		
SL No.	Types of Apparel	Costing
01	Round neck T-shirt	18.00 taka
02	Polo shirt	20.00 taka
03	Shorts	10.00 taka
04	Vests	5.00 taka
05	Briefs	4.00 taka

Image file name: 22TT852 - COSTING OF TEXTILE AND APPAREL PRODUCTION

22TT853 - FASHION MARKETING AND VISUAL MERCHANDISING

Hours per week:

L	T	P	**C**
2	2	0	**3**

PREREQUISITE KNOWLEDGE: Basic knowledge on fashion and visual marketing

COURSE DESCRIPTION AND OBJECTIVES:

This course provides the fundamental concepts of fashion business and marketing, merchandising, sourcing and visual merchandising. The course also gives input for analysing components of Fashion marketing, merchandising, sourcing and visual merchandising. The objective of this course is to inculcate the skills and analyse the basic concepts involved in fashion marketing and visual merchandising.

MODULE 1

UNIT - 1 **8L+0T+0P=08 Hours**

INTRODUCTION TO FASHION BUSINESS:

International fashion business pattern, basic business concepts in Indian apparel export house, business operations in China and other south Asian countries. Business patterns for Indian apparel retail and home textiles. Understanding from concept board to finished product and its sequence.

Fashion Marketing: Defining marketing, marketing mix the objectives of marketing department, market research, different types of markets, marketing strategies with respect to a product/brand, Indian apparel houses international marketing strategies and domestic marketing strategies, marketing models, B to B marketing, B to C marketing, direct marketing, digital marketing.

UNIT - 2 **8L+16T+0P=24 Hours**

MERCHANDISING AND SOURCING:

Merchandising and sourcing: Concepts of merchandising, concepts and apparel product lines, dimensions of product change, determination and development of product line and product range.

PRACTICES:

- Case studies on Creative and technical design in garments and accessories
- Case studies on new product development and seasons of sale, costing
- Case studies on supply chain and demand chain understanding, sourcing negotiations
- Case studies on global co-ordination in sourcing
- Case studies on materials management and quality in sourcing
- Case studies on supplier partnership in sourcing
- Case studies on JIT technology.

MODULE 2

UNIT - 1 **8L+0T+0P=8 Hours**

VISUAL MERCHANDISING FUNDAMENTALS:

Visual merchandising: Definition and functions, History, understanding retail in India, Retail Store; Site and Design, Image Mix: Top Six Elements, Store Exteriors, Store Interiors Display Basics,

Design Basics, Principles of Design, Colour Blocking, People Buy Colours, Signage, Understanding Materials; The Purpose of Planning Fixtures, types of Fixtures, Circulation Plan and Types of Circulation Plans, Meaning and Purpose of a Planogram, Benefits of a Planogram, implementation and maintenance of a Planogram.

UNIT - 2 **8L+16T+0P=24 Hours**

MERCHANDISE PRESENTATION:

Merchandise presentation: Principles of Merchandise Presentation; Categories in Merchandise Presentation; Dominance Factor in Merchandise Presentation; Cross Merchandising

PRACTICES:

- Case studies on Window Display Meaning and Scope
- Case studies on Window Display-Construction
- Case studies on Styling, Display Calendar, Sales Tracking
- Case studies on Handling the mannequin, props, lighting
- Case studies on organising an in-store event, VM tool kit
- Case studies on quality and process in visual merchandising
- Case studies on Standard operating procedures

SKILLS:

- Trace and analyse the steps involved in fashion marketing and visual merchandising.
- Identify the characteristics and components of fashion markets and visual merchandising.
- Analyse fashion market for different products like men's wear, women's wear and kids wear products.
- Identify different visual merchandising fixtures and display methods for fashion retail brands.
- Evaluate the methods of merchandise presentation and its effects on consumer perception.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Concepts of fashion marketing and visual merchandising.	Apply	1	1, 2, 4, 5, 9, 10, 12
2	Concept in fashion products and develop a fashion marketing plan for different styles.	Apply	1, 2	1, 2, 5, 9, 10
3	Design a visual merchandising concept for men's wear, women's wear and kids wear application.	Apply	1, 2	1, 2, 3, 5, 9, 10
4	Demonstrate the knowledge of fashion marketing and visual merchandising using case study examples.	Analyze	2	1, 2, 5, 9, 10, 12
5	Characteristics of merchandise presentation.	Evaluate	1, 2	1, 2, 3, 4, 5, 9, 10, 12

TEXT BOOKS:

1. Elian stone, Jean A samples, “Fashion Merchandising”, McGraw Hill Book Company, NewYork, 1985.
2. Philip Kotler, Kevin Lane Keller, Abraham Koshy, and Mithileshwar Jha, “Marketing Management A South Asian Perspective”, Pearson Education, New Delhi, 2006.

REFERENCE BOOKS:

1. Shivaramu S., “Export Marketing – A Practical Guide to Exporters”, Wheeler Publishing, Ohio, 1996.
2. Warren. J. Keegan and Mark.C.Green , “Global Marketing”, Pearson Prentice Hall, NewDelhi, 2005.
3. Ruth E. Glock, Grace I. Kunz “Apparel Manufacturing Sewn Product Analysis”, 4th edition, Pearson Prentice Hall, NJ, 2005.
4. Mike Easey, “Fashion Marketing”, Third Edition, Wiley- Blackwell Publishing, 2009.
5. Sarah Bailey, Jonathan Baker, Visual Merchandising for Fashion, Fairchild publications, 2019.

Image source :

https://3.bp.blogspot.com/-4YzwqeiXjkI/Upy3Q5aLOYI/AAAAAAAAACM/lWdz1VgwxkQ/s1600/visual+merchandising_image.JPG

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