OPEN ELECTIVE LIST OF R22

Departments	Open Elective 1		Open Elective 2		Open Elective 3	
	Subject Code	**Name of the Subject**	**Subject Code**	**Name of the Subject**	**Subject Code**	**Name of the Subject**
CIVIL ENGINEERING	22CE3261	Disaster Management	22CE4161	Remote Sensing & GIS	22CE4261	Road safety Engineering
	22CE3262	Building Materials and Technologies	22CE4162	Environmental Pollution	22CE4262	Environmental Impact Assessment
ELECTRICAL AND ELECTRONICS ENGINEERING	22EE3261	Renewable Energy Sources	22EE4161	Utilization of Electric Energy	22EE4261	Electrical Energy Conservation and Auditing
	22EE3262	Fundamentals of Electric Vehicles	22EE4162	Energy Storage Systems	22EE4262	Reliability Engineering
MECHNAICAL ENGINEERING	22ME3261	Basic Mechanical Engineering	22ME4161	Quantitative Analysis for Business Decisions	22ME4261	Entrepreneurship Development
	22ME3262	Renewable Energy Sources	22ME4162	Introduction to Rapid Prototyping	22ME4262	Elements of Electric and Hybrid Vehicles
ELECTRONICS AND COMMUNUCATION ENGINEERING	22EC3261	Fundamentals of Internet of Things	22EC4161	Electronic Sensors	22EC4261	Measuring Instruments
	21EC3262	Principles of Electronics and Communications	22EC4162	Electronics for Health Care	22EC4262	Communication Technologies
	22EC3263	Digital Electronics for Engineering	22EC4163	Telecommunications for Society	22EC4263	Fundamentals of Social Networks
COMPUTER SCIENCE ENGINEERING	22CS3261	Data Structure	22CS4161	Operating Systems	22CS4261	Software Engineering
	22CS3262	Database Management Systems	22CS4162	Algorithms Design and Analysis	22CS4262	Introduction to Computer Networks
INFORMATION TECHNOLOGY	22IT3261	Java Programming	22IT4161	Web Development	22IT4261	Big Data Technologies
	22IT3262	Object Oriented Programming using	22IT4162	Fundamentals of Computer Networks	22IT4262	Fundamentals of Block Chain

		C++				Technology
COMPUTER SCIENCE AND BUSINESS SYSTEM (CSBS)	22BU3261	Enterprise Resource Planning	22BU4161	Software Testing Methodology	22BU4261	Innovation IP Management and Entrepreneurship
	22BU3262	Cloud Computing	22BU4162	Design Thinking	22BU4262	DevOps
COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)	22CY3261	Introduction to Cyber Security	22CY4161	Computer Security & Audit Assurance	22CY4261	Data Privacy
	22CY3262	Ethical Hacking	22CY4162	Social Media Security	22CY4262	Cyber Laws
COMPUTER SCIENCE AND ENGINEERING (AIML)	22AM3261	Machine Learning	22AM4161	Neural Networks and Deep Learning	22AM4261	Natural Language Processing
	22AM3262	Artificial Intelligence	22AM4162	Reinforcement Learning	22AM4262	Genetic algorithms & Fuzzy logic
COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)	22DS3261	Fundamentals of Data Science	22DS4161	Data Mining	22DS4261	Introduction to Social Media Mining
	22DS3262	R Programming	22DS4162	Data Analytics	22DS4262	Data Visualization using Python

22CE3261: DISASTER MANAGEMENT
(Open Elective-I)

B.Tech III Year II Semester

L	T	P	C
3	-	-	**3**

Course Objectives:

- To increase the knowledge and understanding basic concepts of Disasters and Hazards
- To impart the knowledge of types of Disasters and vulnerable profile of India
- To infer capacity building concepts and planning of disaster management.
- To interpret the strategies, policies and coping capacities in order to lessen the impact of hazards.
- To demonstrate the role of Government Agencies in disaster planning and policies

Course outcomes:
After learning the contents of this paper the student must be able to

- Understanding Disasters, man-made Hazards and Vulnerabilities
- Understanding disaster management mechanism
- Understanding capacity building concepts and planning of disaster managements
- Understanding coping strategies and alternative adjustment processes
- Understanding role of government agencies in disaster planning and policies

UNIT - I: Understanding Disaster

Concept of Disaster, Environmental Disasters and Environmental Stress- Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional)

Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards, epidemics and pandemics

UNIT - II: Disaster Management Mechanism

Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

UNIT - III: Capacity Building

Capacity Building Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management

UNIT - IV: Coping with Disaster

Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

UNIT - V: Planning for disaster management

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster Management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plans, Legislative Support at the state and national levels.

TEXT BOOKS:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

REFERENCES:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

22CE3262: BUILDING MATERIALS AND TECHNOLOGIES
(Open Elective-I)

	L	T	P	C
B.Tech III Year II Semester	3	-	-	**3**

Course Objectives: The objectives of the course is

- To understand various building materials
- To opherhend knowledge on foundation and masonry
- To study about lintels, arches, roofs and roofs
- To compared knowledge on energy and environmental issues of building materials
- To learn about various building technology

Course Outcomes: After the completion of the course student should be able to

- Define the Basic terminology that is used in the industry
- Categorize different building materials, properties and their uses
- Select the different type's lintels and roofs and floors in industry construction
- Understand the Prevention of damage measures and good workmanship
- Explain different building techniques in industry construction

UNIT I

Building Materials: Stone: as building material, Requirements of good quality stones, dressing of stones, deterioration and prevention of stone work. **Bricks:** Classification, Manufacturing, Requirements of good bricks, Field and laboratory tests on bricks, compressive strength, water absorption, efflorescence, dimension and warpage; cement concrete blocks, stabilized mud blocks, sizes, requirements of good blocks; **Mortar:** Types and requirements; **Timber:** wood, structure, types and properties, seasoning, defects: alternate materials for timber.

UNIT II

Foundation: Investigation of soil, Safe bearing capacity of soil, Functions and requirements of good foundation, types of foundation.

Masonry: Definition and terms used in masonry, Brick masonry, characteristics and requirements of good brick masonry, bonds in brick work; Stone masonry: requirements of good stone masonry, classification, characteristics of different stone masonry, joints in stone masonry; Walls, types of walls, cavity walls.

UNIT-III

Lintels and Arches: Definition, function and classification of lintels, Balconies, Chejja and Canopy; Arches: Elements, types and stability of an arch.

Floors and Roofs: Floors: Requirements of good floor, components of ground floor, selection of floor material, laying of concrete, Mosaic, Marble, Granite, Tile flooring, cladding of tiles. Roof: requirements of good roof, elements of a pitched roof, Trussed roof, King post Truss, Queen post truss, Different roofing material, RCC roof.

UNIT IV

Introduction Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, Environmental friendly and cost effective building ttechnologies, Requirements for building of different climatic regions, Traditional building methods and vernacular architecture.

UNIT V

Building Technologies: Wall construction, Types, Construction method ,Masonry mortars, Types, Preparation, Properties, Ferro cement and ferro concrete building components, Materials and specifications, Properties, Construction methods, Applications , roofing systems, Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes

TEXT BOOKS:

1. Building Materials and Construction – Arora & Bindra, Dhanpat Roy Publications.
2. Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.

REFERENCE BOOKS:

1. Building Materials by Duggal, New Age International.
2. Building Materials by P. C. Varghese, PHI.
3. Construction Technology – Vol – I & II by R. Chubby, Longman UK.
4. Alternate Building Materials and Technology, Jagadish, Venkatarama Reddy and others; New Age Publications.

22CE4161: REMOTE SENSING & GIS
(Open Elective-II)

	L	T	P	C
B.Tech IV Year I Semester	3	-	-	**3**

Course Objectives:

- An opportunity to the students to study modern ground, space and air based surveying techniques.
- To prepare the students to analyse the photographs, images, data, attribute data and know about different types of satellite and its sensors of remote sensing.
- Know the concepts of Geographic Information System (GIS) and coordinate systems used in preparation of different Maps.
- To make the students to analyse the different ground features using vector model.
- Enable the students to know how the features are identified in the cell using raster model

Course Outcomes: After the completion of the course student should be able to

- Analyze aerial photographs.
- Explain electromagnetic spectrum, basic concepts and process of remote sensing.
- Analyze and understand the geographic coordinate system
- Analyze and interpret data using vector data model.
- Analyze and interpret data using raster data model.

UNIT - I

Introduction to Photogrammetry: Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based onrelief displacement, Fundamentals of stereoscopy, Fiducial points, parallax measurement using fiducial line.

UNIT - II

Remote Sensing: Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process. Electro-magnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, vegetation), Indian Satellites and Sensors characteristics, Resolution, Map and Image and False color composite, introduction to digital data, elements of visual interpretation techniques.

UNIT – III

Geographic Information Systems: Introduction to GIS; Components of a GIS; Geospatial Data: Spatial Data-Attribute data – Joining Spatial and Attribute data; GIS Operations: Spatial Data Input- Attribute data Management –Data display- Data Exploration- Data Analysis. COORDINATE SYSTEMS: Geographic Coordinate System: Approximation of the Earth, Datum; Map Projections: Types of Map Projections-Map projection parameters commonly used Map Projections - Projected coordinate Systems.

UNIT – IV

Vector Data Model: Representation of simple features- Topology and its importance; coverage and its data structure, Shape file; Data models for composite features Object Based Vector Data Model; Classes and their Relationship; The geobase data model; Geometric representation of Spatial Feature and data structure, Topology rules.

UNIT - V

Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data.

Data Input: Metadata, Conversion of Existing data, creating new data; Remote Sensing data, Field data, Text data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing

TEXT BOOKS:

1. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015.
2. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015

REFERENCES:

1. Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
2. Principals of Geo physical Information Systems – Peter A Burragh and Rachael A. Mc Donnell,Oxford Publishers 2004.
3. Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications.
4. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.
5. Text Book of Remote Sensing and Geographical Information Systems by M. Anji Reddy – 4th EditionB.S.Publications

22CE4162: ENVIRONMENTAL POLLUTION
(Open Elective-II)

B.Tech IV Year I Semester

L	T	P	C
3	-	-	**3**

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the natural resources and biodiversity for sustainable life style
- Understanding the various types of environmental pollutions and their effects
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the various environmental issues

Course Outcomes: At the end of the course, the student able to

- Define the importance of ecological balance and bio diversity
- Suggest natural resources & bio diversity for sustainable life style
- Identify various environmental pollutants and their effects
- Suggest various management methods
- Identify various causes of environmental issues

UNIT - I

Multidisciplinary Nature of Environment: -Introduction, objectives, scope and importance , science of environment, Need of Public awareness , world environment Day , Environmental Protection

Chemistry of environmental pollutants Definition of pollution; pollutants; classification of pollutants; solubility of pollutants (hydrophilic and lipophilic pollutants), transfer of pollutants within different mediums, role of chelating agents in transferring pollutants, concept of biotransformation and bioaccumulation, concept of radioactivity, radioactive decay and half-life of pollutants

UNIT - II

Natural resources- Renewable and non-renewable Resources –Forest Resouces, Water resources, mineral resources, Food resources energy resources, energy resouces, land resources, ,Equitable use of resources for sustainable life style

Ecosystem and biodiversity - Natural and Artificial ecosystems –impacts of Human on Ecosystems ,biodiversity , Biological classification of India , threats of biodiversity endangered and endemic species of India ., value of biodiversity, India as a mega-diversity nation , Biodiversity at global , national and local level

UNIT – III

Environmental pollution and management – sources ,effects on environment and Humans , types of environmental pollution, Role of an individual in prevention of Pollution , sources of surface and ground water pollution , Eutrophication , effect of water contaminants on human health , marine pollution –souces, oil spills ,coral reefs and their demise , existing challenges and management

Management and Effects - Floods, earthquake , cyclone ,landslides ,Tsunami

UNIT – IV

Social issues and the environment - unsustainable to sustainable Development –case studies, urban problems related to energy –Definition, Need , Barriers , promoting of energy conservation , water conservation and management – water conservation , Rain water Harvesting , Water shed management –case study , Population Explosion

Environmental protection laws in India – water air, wildlife protection , Indian forest , environment protection act , Issues involves in enforcement of environmental Legislation

UNIT - V

Environmental Issues: Definition, need and objectives of environmental protection. – issues and effects of environmental problems –Automobile pollution, soil degradation, Global warming, over population, Natural Resources Depletion, waste Disposal , leachate formation ,Loss of biodiversity , climate change , Ocean Acidification, Nitrogen cycle ,, acid rains,,over fishing ,Public Health issues,Urban sprawl.

TEXT BOOKS:

1. Environmental Science And Engineering by Dr.Suresh K.Dhameja S.K,Kataria Sons , third Edition :2006-2007
2. Text book of Environmental Studies by Erach Bhaurach , University Grants commission , University Press

REFERENCES :

1. Text bo ok of Environmental Science –Dr.Anji Reddy 2007, BS Publications
2. Introduction to Environmental Science by Y.Anjaneyulu BS Publications
3. Environmental science :toward a Sustainable Future by Richard T.Wright.2008 PHL Learning Privated Ltd.New Delhi

22CE4261: ROAD SAFETY ENGINEERING

(Open Elective-III)

	L	T	P	C
B.Tech IV Year II Semester	3	-	-	**3**

Course Objects: To learn

- The fundamental of traffic Engineering & some of the statistical methods to analysis the traffic safety.
- The accident interrogations risk involved with measures to identity the causes of accidents.
- The role of road safety in planning and geometric design of roads.
- The role of road safety in planning the urban infrastructures design.
- The various traffic management systems for safety & safety improvement strategies

Course Outcomes: By the end of this course, Students should be able to

- Understand fundamental of Traffic Engg.
- Investigate & determine the collective factors & remedies of accident involved.
- Design & planning various road geometrics.
- Massage the traffic system from road safety point of view.
- Know various traffic management systems

UNIT I:

Fundamentals of Traffic Engineering - Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Traffic Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

UNIT II:

Accident Investigations and Risk Management, Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction

UNIT III:

Road Safety in Planning And Geometric Design: Vehicle And Human Characteristics, Road Design and Road Equipment's, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care

UNIT IV: Role of Urban infrastructure design in safety: Geometric Design of Roads; Design of Horizontal and Vertical Elements, Junctions, At Grade and Grade Separated Intersections, Road Safety in Urban Transport, Sustainable Modes and their Safety.

UNIT V:

Traffic Management Systems for Safety, Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety Improvement Strategies, ITS and Safety.

Text Books:

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
2. Fundamentals of Transportation Engineering - C. S. Papacostas, Prentice Hall India.
3. Transportation Engineering – An Introduction, C. Jotin khisty, B. Kent Lall

References

1. Fundamentals of Traffic Engineering, Richardo G Sigua
2. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson
3. Road Safety by NCHRP

22CE4262: ENVIRONMENTAL IMPACT ASSESSMENT

(Open Elective-III)

B.Tech. IV Year II Sem

	L	T	P	C
Course Objectives: To	3	-	-	3

- Understand the basic terminologies of EIA and methodologies of EIA.
- Understand the assessment of deforestation and its impact predictions.
- Explain assessment of soil quality and its impact prediction.
- Understand environment Audits and its methods.
- Understand various Acts and case studies.

Course Outcomes: At the end of the course, the student will be able to

- Discuss the objectives of EIA studies and identify the methodologies to prepare EIA.
- Identify and incorporate mitigation measures of deforestation.
- Identify and incorporate mitigation measures of soil quality.
- Execute Audit report.
- Apply various environmental acts in the preparation of case study reports.

UNIT – I

Basic concept of EIA: Initial environmental Examination, Elements of EIA, - factors affecting E-I-AImpact evaluation and analysis, preparation of Environmental Base map, Classification ofenvironmental parameters. E I A Methodologies: introduction, Criteria for the selection of EIAMethodology, E I A method, Ad-hoc method, matrix method, Network method and overlay method.

UNIT- II

Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact ofDeforestation – Causes and effects of deforestation.

UNIT- III

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures.

UNIT – IV

Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocel, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

UNIT – V

The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution Act.), Motor Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries-Water resource projects, sewage treatments plant, municipal solid waste processing plant, thermal plant and airport.

TEXT BOOKS:

1. Larry Canter – Environmental Impact Assessment, McGraw-Hill Publications
2. Environmental Impact Assessment, Barthwal, R. R. New Age InternationalPublications

REFERENCES:

1. Environmental Pollution by R.K. Khitoliya S. Chand, 2014.
2. Glynn, J. and Gary, W. H. K. - Environmental Science and Engineering, Prentice HallPublishers
3. Suresh K. Dhaneja - Environmental Science and Engineering, S.K. Kataria & SonsPublication. New Delhi.
4. Bhatia, H. S. - Environmental Pollution and Control, Galgotia Publication (P) Ltd,Delhi.
5. Wathern, P. – Environmental Impact Assessment: Theory & Practice, Publishers-Rutledge, London, 1992.

.

22EE3261: RENEWABLE ENERGY SOURCES
(Open Elective-I)

III B.Tech. II-Sem **L T P C**
3 0 0 3

Prerequisite: Electrical Machines –II, Power System- I, Power Electronics.

Course Objectives:

- To acquire knowledge on the concepts of Wind Energy Conversion Systems.
- To study and understand wind generation topologies.
- To know the concepts of Solar Thermal Power Generation.
- To study the characteristics of photo voltaic cells.
- To study the concepts of renewable energy systems other than solar and wind power generations.

Course Outcomes: At the end of this course students will demonstrate the ability to

- Discuss the energy scenario from wind energy conversion system.
- Analyze Wind Generator Topologies.
- Discuss the solar resources & solar thermal power generation.
-]Analyze the characteristics of photo voltaic systems.
- Differentiate the concepts of renewable power generations excluding solar and wind.

UNIT - I:

Wind Energy: Introduction to Wind energy, Site selection consideration, Basic component of Wind Energy Conversion Systems (WECS) ; Classification of Wind Energy Conversion system- Horizontal axis & Vertical axis; Advantages & Disadvantages of wind energy conversion system

UNIT - II:

Wind Generator Topologies: Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators,

UNIT - III:

Solar Thermal Power Generation: Introduction, solar radiation- Beam & Diffuse radiation, solar geometry, Earth Sun angles, observer Sun angles, solar day length, focusing type
Solar Collector - Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond.

UNIT - IV:

Solar Photovoltaic: Basic Principle of solar photovoltaic conversion, Types of Solar Cells - Amorphous, Mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, Maximum Power Point Tracking (MPPT) algorithms.

UNIT - V:

Other Renewable Energy Sources: Energy from Bio mass: conversion processes, Geothermal Power Plant: Dry Steam System, Flash Steam System, Binary Cycle System; MHD Generation, Ocean Thermal Energy Conversion (OTEC), Energy from the tides

TEXT BOOKS:

1. T. Ackermann, “Wind Power in Power Systems”, John Wiley and Sons Ltd., 2nd Edition, 2012.
2. G. D. Rai, “Non-Conventional Energy Sources”, Khanna Publishers, 2011.
3. G. M. Masters, “Renewable and Efficient Electric Power Systems”, John Wiley and Sons, 2004.

REFERENCE BOOKS:

1. D.P.Kothari, K.C Singal, Rakesh Ranjan “Renewable Energy Sources and Emerging Technologies”, Third Edition, PHI Learning Pvt. Ltd, New Delhi, 2022.
2. S. P. Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, 2nd Edition, McGrawHill, 2012.
3. H. Siegfried and R. Waddington, “Grid integration of wind energy conversion systems” JohnWiley and Sons Ltd., 2006.

22EE3262: FUNDAMENTAL OF ELECTRIC VEHICLES
(Open Elective-I)

III B.Tech. II-Semester

L	T	P	C
3	0	0	3

Pre-requisites: None; Interest in electric Vehicles

Course Objectives:

- To know the fundamentals of Electric Vehicles (EVs), especially in Indian Context.
- To know the vehicle dynamics
- To examine technology associated with each element of EV drive-train
- To study about EV motors and controllers used in EV
- To know about EV Charging process and charging stations

Course Outcomes: At the end of the course the student will be able to:

- Explain the fundamentals of Electric Vehicles.
- Analyze the vehiicle dynamics
- Discuss technology associated with each element of EV drive-train;
- Design EV motors and Power electronic controllers for EV systems
- Classify various EV Charging processes

UNIT-I:

Introduction : Overview of Electric Vehicles in India, India's EV program, Charging and Swapping Infrastructure, briefintroduction of batteries, Lithium for batteries, EV Subsystems.

UNIT-II:

Vehicle Dynamics: Forces acting when a vehicle move, Aerodynamic drag, Rolling Resistance and Uphill Resistance, Power and Torque to accelerate. **Drive Cycle:** Concept of Drive Cycle, Drive Cyclesand Energy used per km.

UNIT-III:

EV Power train: Design of EV Drive Train, Introduction to Battery Parameters, Why Lithium Ion Battery? Batteries in Future, Li-Ion Battery Cells, SoH and SoC estimation and Self Discharge, Battery Pack Development, Computation of Effective cost of battery, Charging Batteries.

Fundamentals of EV Battery Pack design: Mechanical, Thermal and Electrical Design, BMS Designof Electric Vehicle.

UNIT-IV:

EV Motors and Controllers: Fundamentals and Design, Understanding Flow of Electricity, Magnetism and Heat, Power and Efficiency, Torque Production, Speed and Back EMF, the d-q Equivalent circuit, Field-oriented Control, Understanding Three phase AC and DC to AC conversion systems, Understanding the thermal design of the motors, Engineering Considerations, Future Frontiers.

UNIT-V:

EV Charging: Introduction, Slow or Fast EV Chargers, Battery Swapping, Standardization and On board Chargers, Public Chargers, Bulk Chargers/Swap Stations, Economics of Public Chargers in context, Analytics and Tools for EV systems.

TEXT BOOKS:

1. Electric Powertrain - Energy Systems, Power electronics and drives for Hybrid, electric and fuelcell vehicles by John G. Hayes and A. Goodarzi, Wiley Publication
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric andFuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004
3. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003

REFERENCE BOOKS:

1. James Larminie, John Lowry, *Electric Vehicle Technology Explained*, Wiley, 2003
2. Chris Mi, M. Abul Masrur, David Wenzhong Gao, *Hybrid Electric Vehicles: Principles andApplications with Practical Perspectives*, John Wiley & Sons Ltd., 2011
3. Fundamentals of Electric Vehicles: technology and economics https://onlinecourses.nptel.ac.in/noc20_ee99/preview https://archive.nptel.ac.in/courses/108/106/108106170/
4. Link to EV101 course — https://www.pupilfirst.school/courses/641/curriculum
5. Link to EV201 course: https://www.pupilfirst.school/courses/643/curriculum

22ME3261: BASIC MECHANICAL ENGINEERING
(OPEN ELECTIVE – I)

B.Tech. III Year, II Sem.

L	T	P	C
3	0	0	3

Pre requisites -Nil

Course Objectives:

1. Understanding of basic principles of Mechanical Engineering is required in various field of engineering.
2. Understand about energy and Global warming
3. Understand about properties of steam and Steam boilers
4. Discuss about pumps and Compressors
5. Discuss about Various elements of power transmission systems

Course Outcomes:

By the end of this course, Students should be able to

1. Understand the Fundamentals of mechanical systems
2. Understand the Fundamentals of Properties of Gas, Steam & Steam Turbines
3. Choose Suitable IC Engines for Different applications and Classify the Heat Engines
4. Choose Suitable Pumps and Compressors, Refrigeration & Air conditioning Systems for Different Applications.
5. Classify Power Transmission Systems and Select Suitable Power transmission Systems and Materials for different applications.

UNIT- I:

Energy: Power Generation: External and internal combustion engines-Thermal Power Plants-Working Principle, layouts, element/component description, advantages, disadvantages, applications.Stroke, 4-Stroke Engines and their Components.

Refrigeration: Mechanical Refrigeration and types – units of refrigeration – Air Refrigeration system, Vapour Compression Refrigeration System- Principle of operation.

UNIT- II:

Machine and Mechanisms-Degrees of Freedom, functions of Flywheel and Governors,Types of joints-Riveted, welded and bolted joints. Applications, Merits and Demerits.Power Transmission Elements: Gears terminology of spur, helical and bevel gears, gear trains. Belt drives (types). Chain drives.

UNIT- III:

Manufacturing Processes: Primary and secondary process. Casting: Types, equipment, applications. Metal forming processes-rolling, extrusion
Welding: Types – Equipment –Techniques employed – advantages / disadvantages – Gas cutting –Brazing and soldering.

UNIT- IV:

Machine Tools: Introduction to lathe, drilling machine, milling machine, grinding machine-Operations performed. CNC Machines- Basic elements, advantages. Limits, fits and tolerances, Surface finish of various manufacturing process.

UNIT- V:

Non-conventional sources of energy-Solar, wind, tidal, biogas and nuclear- Principles. Robotics – Joints, end effectors, applications. Introduction to 3D Printing.

TEXT BOOKS:

1. Sadhu Singh, Basic Mechanical Engineering, S. Chand & Co. Ltd, New Delhi, 2013
2. Pravin Kumar, Basic mechanical Engineering, 2018, Pearson

REFERENCE BOOKS:

1. Hajra Choudhary, S.K. and Hajra Choudhary, A. K., Elements of Workshop Technology Vols.I& II, Indian Book Distributing Company Calcutta, 2007.
2. Nag, P.K., Power Plant Engineering, Tata McGraw-Hill, New Delhi, 2008.
3. Rattan, S.S., Theory of Machines, Tata McGraw-Hill, New Delhi, 2010.

22ME3262: RENEWABLE ENERGY SOURCES

(OPEN ELECTIVE – I)

B.Tech. III Year, II Sem.

L	T	P	C
3	0	0	3

Pre requisites -Nil

Course Objectives: The Objective of this course is to provide the student to

1. Introduce the need of the non-convectional energy sources.
2. Differentiate various solar collectors
3. Identify the energy resources utilization systems
4. Recognize the source and potential of wind energy and understand the classifications of wind mills.
5. Summarize the principles of bio-conversion, ocean energy and geo thermal energy.

Course Outcomes: At the end of the course students will be able to

1. Choose the appropriate renewable energy as an alternate for conventional power in any application.
2. Understand principles of various solar collectors and use them in different applications
3. Inculcate the knowledge on usage of alternate energy sources in I.C Engines
4. Know various energy conversion techniques
5. Analyze large scale demand of heat energy for meeting day to day domestic, institutional and industrial requirements can be met by utilizing solar thermal systems, biogas, PV cells, wind energy, Geothermal, MHD etc.

UNIT- I:

Solar Radiation And Collecting Devices: Solar Incident Flux, Extra-terrestrial Radiation, Clear Sky Irradiation, Solar Radiation Measurement, Monthly Average Radiation on Tilted Surfaces. Cover plates, Collector Plate Surfaces, Collector Performance, Collector Improvement, Effect of Incident Angle, HeatTransfer to Fluids, Heat Transfer Factors, Concentrating Collectors, Reflectors.

UNIT- II:

Solar System Design And Economic Evaluation Hot water heating, heating and hot water systems, pumps and fans, sizing pipe and duct work, fundamentals of economic analysis, systems optimization

UNIT- III:

Wind Energy Systems: Orientation systems and Regulating devices, Types of Wind Turbines, Operating Characteristics, Basics of Airfoil Theory, Wind energy for water pumping and generation of electricity, Installation operation and maintenance of small wind energy conversion systems.

UNIT-I V:

Energy From Water: OTEC–Principle of operation, Open and Closed OTEC cycles, Wave energy: Wave energy conversion machines and recent advances Tidal Energy: Single basin and double basin tidal systems Small-Mini-Micro hydro system: Concepts, Types of turbines, Hydrological analysis.

UNIT- V:

Geothermal Energy: Introduction, Classification of Geo-thermal areas, Applications of Geo-thermal energy for power generation, Economics of Geo-thermal energy. MHD POWER GENERATION: Principles of MHD Power Generation, Ideal MHD–Generator Performance, Practical MHD Generator: Faraday and Hall Configurations, MHD Technology.

TEXT BOOKS:

1. Non-Conventional sources of Energy by G. D. Rai, Kanna Publications.
2. Non-conventional Energy resources, BH Khan, McGraw-Hill

REFERENCE BOOKS:

1. Fundamentals of Renewable Energy Sources, G. N. Tiwari, Ghosal, Alpha Science
2. Solar Energy Fundamentals and Applications, H. P Garg, Prakash, TMH.
3. Solar Energy: Principles of thermal storage, S. P Sukhatme, TMH

22EC3261: FUNDAMENTALS OF INTERNET OF THINGS
(Open Elective I)

B.Tech III Year II Semester

L	T	P	C
3	-	-	**3**

Course Objectives:

1. To learn about the IoT Architecture and Protocol
2. To introduce IoT protocol and its applications
3. To learn about the IoT Physical Devices and End Points
4. To understand the various types of cloud services
5. To know the Privacy and Security Issues of IoT devices.

Course Outcomes: Upon completion of the Course, the students will be able to

1. Understand the IoT technology and IoT architecture
2. Know about the IoT communication models
3. Develop IoT application using Raspberry PI
4. Classify various types of Cloud Computing
5. Understand the security in IoT

UNIT I

Introduction, IoT Components, Characteristics of IoT, IoT technologies, Issues and Challenges of IoT, IoT Architecture, IoT Impact, IoT Network Architecture and Design, The Core IoT Functional Stack

UNIT II

M2M to IoT an architectural overview, IoT reference model, main design principles and need Capability, Physical Design of IoT – IoT Protocols, IoT communication models, Domain pecific IoTs, IoT applications– Home, City, Environment, Energy, Retail, Agriculture, Industry, health

UNIT III

IoT Physical Devices and End Points: What is an IoT Device? Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Other IoT Devices.

UNIT IV

IoT Physical Servers and Cloud Based Services, Types of Cloud Computing, Software as a Service (Saas), Platform as a service (PaaS), Infrastructure as a service (IaaS), anything as a Service (XaaS) , Virtualization In Cloud Computing and Types, Virtualization benefits , Issues In Cloud Computing, Characteristics of Cloud Computing.

UNIT V

Internet of Things Privacy, Security and Governance: Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT Data Platforms for Smart Cities, First Steps Towards a Secure Platform

TEXT BOOKS

1. ArshdeepBahga and Vijai Madisetti, A Hands-on Approach Internet of Things, Universities Press, 2015.
2. Gastón C. Hillar, Internet of Things with Python, Packt Publishing Ltd 2016.

REFERENCE BOOKS

1. Rethinking the Internet of Things: A scalable Approach to Connecting Everything, by Francisda Costa, ISBN: 978-1-4302-5740-0, 2013
2. Architecting the Internet of Things, by Dieter Uckelmann, Mark Harrison and Florian Michahelles, ISBN: 978-3-642-19157-2, 2011.

22EC3262: PRINCIPLES OF ELECTRONIC COMMUNICATIONS
(OPEN ELECTIVE-I)

B.Tech. III Year II Sem. **L T P C**

3 0 0 3

Course Objectives:

1. Able to understand the basic concepts of modulation in communications and evaluation of itsparameters.
2. Able to understand different modulation schemes in analog and digital communications.
3. Able to have the basic knowledge about telecommunication systems, Internet and incommunication networking.
4. Able to understand the basic concepts and techniques with satellite communications and opticalcommunications.
5. Able to understand the concepts behind cellular and mobile communications and able to applythese concepts in wireless networking.

Course Outcomes:

1. understands the different parametric measurable in communication systems
2. Understands the basic concepts of different modulation techniques.
3. Understands the basic concepts of switching networks.
4. Understands the basic concepts of satellite and optical communications
5. Understands the basic concepts of cellular mobile communications and wireless technologies.

UNIT – I

Introduction: Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation anddecibels.

UNIT – II

Simple description on Modulation: Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM,PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

UNIT – III

Telecommunication Systems: Telephones Telephone system, Paging systems, InternetTelephony. Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token RingLAN.

UNIT IV

Satellite Communication: Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems. Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT V

Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA,and WCDMA. Wireless Technologies: Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

Text Books

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications, 2008
2. Electronic Communications systems, Kennedy, Davis 4e, MC GRAW HILLEDUCATION, 1999
3. Theodore Rapp port, Wireless Communications - Principles and practice, PrenticeHall, 2002.

REFERENCES:

1. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications
2. Introduction to data communications and networking, Wayne Tomasi, PearsonEducation, 2005

22EC3263: DIGITAL ELECTRONICS FOR ENGINEERING
(Open Elective–I)

B.Tech. III Year II Sem **L T P C**

3 0 0 3

Course Objectives:

1. Understand fundamental concepts of Digital Systems, Boolean theorems, various logic gates
2. Understand the design of combinational and Arithmetic Circuits
3. Understand the applications of sequential circuits
4. Acquire knowledge on various types of Memories
5. Familiarize the concepts of Opamp and A/D, D/A converters

Course Outcomes:

1. Understand the concepts of Digital Systems, Boolean theorems, various logic gates
2. Understand the design of combinational and Arithmetic Circuits
3. Understand the applications of sequential circuits
4. Understand various types of Memories
5. Understand the concepts of Opamp and A/D , D/A converters

UNIT – I

Introduction: Definition of Analog & Digital information. Characteristics of Digital Circuits, Advantages of Digital systems, Introduction to ICs, Classification of Analog and Digital ICs, Basic Logic gates, Boolean Algebra- Theorems

UNIT – II

Combinational Circuits: Multiplexer, Demultiplexer, Decoder, Encoder, Priority Encoders
Arithmetic circuits: Half Adder and Full adder Circuits, multibit ripple-carry adder and subtractor circuits. Realization of these circuits using Multiplexers.

UNIT – III

Sequential Circuits: Definition, Elements of sequential circuits - Latches and Registers, Different kinds of flip-flops – R-S, J-K, Master-slave arrangement, D, and T type registers;Typical sequential circuits -counters, shift registers and sequence generator, synchronous and asynchronous circuits

UNIT IV

Memories: RAM- SRAM, DRAM; ROM and its types, PLA, PAL, Secondary Memories

UNIT V

Introduction to Opamps: Inverting and Non-Inverting Amplifiers, Virtual ground Concept, Analog to Digital and Digital to Analog Converrters

TEXT BOOKS

1. Digital Design, 5/e, Morris Mano and Michael D. Cilette, Pearson, 2011
2. Digital Principles, 3/e, Roger L. Tokheim, Schaum's outline series, 1994
3. Linear Integrated Circuits, D. Roy Chowdhury, New Age International(p)Ltd., 6thEdition, 2018.

REFERENCES:

1. Modern Digital electronics- RP Jain 4th Edition, McGraw Hill, 2010
2. Switching Theory and Logic Design – A. Anand Kumar, 3rd Edition, PHI, 2013.
3. Op-Amps & Linear ICs, Ramakanth A. Gayakwad, PHI, 2015

22CS3261 DATA STRUCTURES
(Open Elective – I)

B.Tech. III Year II Sem. **L T P C**

3 0 0 3

Prerequisites

A course on "Programming for Problem Solving

Course Objectives

- Gaining Basic Knowledge on Linear and Non Linear Data Structures
- Exploring basic data structures such as stacks and queues.
- Introduces a variety of data structures such as hash tables, search trees, tries, heaps, andgraphs.
- Introduces searching, sorting and pattern matching algorithms.
- Understand the concepts of Search Trees.

Course Outcomes

- Ability to design and analyze the time and space complexity and understand the concepts
- Linked List of data structures.
- Understand data structure concepts of Stacks and Queues.
- Understand data structure concepts of Trees, Graphs.
- Understand the concepts of Searching and Sorting.

UNIT - I

Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks- Operations, array and linked representations of stacks, stack applications, Queues- operations, array and linked representations.

UNIT - II

Dictionaries: linear list representation, skip list representation, operations - insertion, deletion and searching. Hash Table Representation: hash functions, collision resolution-separate chaining, open addressing linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

UNIT - III

Search Trees: Binary Search Trees, Definition, Implementation, Operations- Searching, Insertion and Deletion, B- Trees, B+ Trees, AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion,Deletion and Searchin g, Red –Black, Splay Trees.

UNIT - IV

Graphs: Graph Implementation Methods. Graph Traversal Methods. Sorting: Quick Sort, Heap Sort, External Sorting- Model for external sorting, Merge Sort.

UNIT - V

Pattern Matching and Tries: Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix tries.

TEXT BOOKS:

1. Fundamentals of Data Structures in C, 2 nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.
2. Data Structures using C – A. S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education.

REFERENCE BOOK:

1. Data Structures: A Pseudocode Approach with C, 2 nd Edition, R. F. Gilberg and B.A.Forouzan,Cengage Learning.

22CS3262: DATABASE MANAGEMENT SYSTEMS
(Open Elective – I)

B.Tech. III Year II Sem. **L T P C**
3 0 0 3

Prerequisites:

- A course on "Data Structures".

Course Objectives:

- To understand the basic database concepts, applications, data models, schemas and instances.
- To demonstrate the use of constraints and relational algebra operations.
- To become proficient in the basics of SQL and construct queries using SQL and normalization techniques.
- To demonstrate the basic concepts of transaction processing and concurrency control
- To familiarize the concepts of database storage structures and the access techniques

Course Outcomes:

- Demonstrate the basic elements of a relational database management system.
- Ability to design entity relationship model and convert in to relational model.
- Formulate SQL queries on the data and apply normalization for the development of application software.
- Analyses transaction processing, concurrency control and recovery management techniques.
- Analyses the storage structures and indexing.

UNIT - I

Database System Applications: A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes, and EntitySets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design With the ER Model

UNIT - II

Introduction to the Relational Model: Integrity constraint over relations, enforcing integrityconstraints, querying relational data, logical database design, introduction to views, destroying/altering tables and views.Relational Algebra, Tuple relational Calculus, Domain relational calculus.

UNIT - III

SQL: QUERIES, CONSTRAINTS, TRIGGERS: form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL,triggers and active databases. Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multivalued dependencies, FOURTH normal form, FIFTH normal form.

UNIT - IV

Transaction Concept, Transaction State, Implementation of Atomicity and Durability, ConcurrentExecutions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols, Multiple Granularity, Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions.

UNIT - V

Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree based Indexing, Comparison of File Organizations, Indexes- Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM),B+ Trees: A Dynamic Index Structure.

TEXT BOOKS:

1. Database System Concepts, Silberschatz, Korth, McGraw hill, V edition. 3rd Edition
2. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill

REFERENCE BOOKS:

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7thEdition.
2. Fundamentals of Database Systems, Elmasri Navrate, Pearson Education
3. Introduction to Database Systems, C. J. Date, Pearson Education
4. Oracle for Professionals, The X Team, S.Shah and V. Shah, SPD.
5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI.
6. Fundamentals of Database Management Systems, M. L. Gillenson, Wiley Student Edition.

22CS4161: OPERATING SYSTEMS
(Open Elective –II)

B.Tech. IV Year I Sem. **L T P C**

3 0 0 3

Prerequisites:

- A course on "Computer Programming and Data Structures".
- A course on "Computer Organization and Architecture".

Course Objectives:

- Provide an introduction to operating system concepts (i.e, Operating System services, OS Structure)
- Introduces the way an operating system can make the computer more productive by the effective management of processes (i.e., threads,scheduling, Synchronization)
- Introduce basic UNIX commands, system call interface for process management; inter process communication and I/O in UNIX.
- To understand the basic memory management of operating system.
- To elucidate deadlocks, present a number of various techniques for preventing or avoiding or recovering from deadlocks in a computer system

Course Outcomes:

- Will be able to explain services & structure of operating systems
- Demonstrate the knowledge of the components of computer and their respective roles in computing and illustrate various methods of process scheduling, synchronization.
- Ability to recognize and resolve user problems related to memory management with standard operating system techniques.
- Gain practical knowledge of how programming languages, operating systems, and architectures interact and how to use each effectively to implement file system directory Structures
- Will be able to apply security mechanisms and techniques to handle deadlocks.

UNIT - I

Operating System - Introduction, Structures - Simple Batch, Multi programmed, Time-shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls Process - Process concepts and scheduling, Operations on processes, Cooperating Processes, Threads

UNIT - II

CPU Scheduling - Scheduling Criteria, Scheduling Algorithms, Multiple -Processor Scheduling. System call interface for process management-fork, exit, wait, wait pid, exec Deadlocks - System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock

UNIT - III

Process Management and Synchronization - The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors Inter process Communication Mechanisms: IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory.

UNIT - IV

Memory Management and Virtual Memory - Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Page Replacement, Page Replacement Algorithms.

UNIT - V

File System Interface and Operations -Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management. Usage of open, create, read, write, close, lseek, stat, ioctl system calls.

TEXT BOOKS:

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley
2. Advanced programming in the UNIX environment, W.R. Stevens, Pearson education.

REFERENCE BOOKS:

1. Operating Systems- Internals and Design Principles, William Stallings, Fifth Edition–2005, Pearson Education/PHI
1. Operating System A Design Approach- Crowley, TMH.
2. Modern Operating Systems, Andrew S. Tanenbaum 2nd edition, Pearson/PHI
3. UNIX programming environment, Kernighan and Pike, PHI/ Pearson Education
4. UNIX Internals -The New Frontiers, U. Vahalia, Pearson Education.

22CS4162: ALGORITHMS DESIGN AND ANALYSIS
(Open Elective –II)

B.Tech. IV Year I Sem. **L T P C**

3 0 0 3

Prerequisites:

- Programming for problem solving and Data Structures

Course Objectives

- To analyse performance of algorithms.
- To understand and choose the appropriate algorithm design technique for a specified application.
- To solve problems using algorithm design techniques such as the greedy method, divide and conquer, dynamic programming, backtracking and branch and bound.
- To analyze the impact of algorithm design techniques on each application solved.
- To introduce and understand P and NP classes

Course Outcomes

- Able to analyze the different algorithm design techniques for a given problem.
- Able to design algorithms for various computing problems.
- Able to argue the correctness of algorithms using inductive proofs and invariants.
- Able to synthesize set operations
- Able to explain about coping with the limitations of algorithms**.**

UNIT - I

Introduction: Algorithm, Performance Analysis-Space complexity, Time complexity, Asymptotic Notations- Big oh notation, Omega notation, Theta notation and Little oh notation. Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen' matrix multiplication.

UNIT - II

Disjoint Sets: Disjoint set operations, union and find algorithms, Priority Queue- Heaps, Heap sort Backtracking: General method, applications, n-queen's problem, sum of subsets problem, graph Coloring, Hamiltonian cycles.

UNIT - III

Dynamic Programming: General method, applications- Optimal binary search tree, 0/1 knapsack problem, All pairs shortest path problem, Traveling sales person problem, Reliability design.

UNIT - IV

Greedy method: General method, applications- Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem .Basic Traversal and Search Techniques: Techniques for Binary Trees, Techniques for Graphs,Connected components, Biconnected components.

UNIT - V

Branch and Bound: General method, applications - Travelling sales person problem, 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution.NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem.

TEXT BOOK:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharan, University Press.

REFERENCE BOOKS:

1. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.
2. Introduction to Algorithms, second edition, T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, PHI Pvt. Ltd./ Pearson Education.
3. Algorithm Design: Foundations, Analysis and Internet Examples, M.T. Goodrich and R.Tamassia, John Wiley and sons.

22CS4261: SOFTWARE ENGINEERING
(Open Elective –III)

B.Tech. IV Year II Sem. **L T P C**
3 0 0 3

Prerequisites:

- Computer Programming
- Database Management Systems

Course Objectives

- To understand fundamental principles of Software engineering, and their application inthe development of software products.
- To understand and create the software requirements specifications document.
- To understand and use unified modeling language for specifying, analysis and designing.
- To understand testing strategies for testing software applications
- To understand Software metrics, Risk Management strategies and software process improvement.

Course Outcomes

- Able to apply the software engineering lifecycle phases communication, planning, analysis, design, construction, and deployment.
- Ability to translate end-user requirements into system and software requirements into Software Requirements specification Document (SRS)
- Able to apply UML in object-oriented software modeling to develop computer software.
- Able to identify problems in software and will be able to develop a simple testing report.
- Able to apply Software Metrics to mitigate risks thereby improving software process

UNIT - I

Introduction to Software Engineering: The evolving role of software, changing nature of software,software myths.A Generic view of process: Software engineering- a layered technology, a process framework, thecapability maturity model integration (CMMI) Process models: The waterfall model, Spiral model and Agile methodology

UNIT - II

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document. Requirements engineering process: Feasibility studies, requirements elicitation and analysis,requirements validation, requirements management.

UNIT - III

Design Engineering: Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

UNIT - IV

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging .Metrics for Process and Products: Software measurement, metrics for software quality.

UNIT - V

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

TEXT BOOKS:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, McGraw Hill International Edition.
2. Software Engineering- Sommer ville, 7th edition, Pearson Education.

REFERENCE BOOKS:

1. The unified modeling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.
1. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies.
3. Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

22CS4262: INTRODUCTION TO COMPUTER NETWORKS

(Open Elective – III)

B.Tech. IV Year II Sem. **L T P C**
3 0 0 3

Prerequisites

- A course on "Programming for problem-solving"
- A course on "Data Structures"

Course Objectives

- To introduce an overview of the concepts and fundamentals of computer networks.
- To Study Data Link Layer Concepts, Design issues, and protocols.
- Familiarize the working mechanism of the network layer.
- Understanding of Transport Layer Concepts and Protocols.
- To Explore the concepts of DNS,E-Mail, WWW, and various application layer Protocols.

Course Outcomes

- Gain knowledge of basic computer network technology.
- Gain knowledge of the functions of each layer in the OSI and TCP/IP reference model.
- Obtain skills in subnetting and routing mechanisms.
- Familiarity with the essential protocols of computer networks, and how they can be
- applied in network design and implementation.
- Gain Knowledge of E-Mail Protocols, Streaming Audio, and Video on the Web

.UNIT - I

Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet. Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless Transmission. Data link layer: Design issues, framing, Error detection and correction.

UNIT - II

Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel. Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols .Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols, Data link layer switching.

UNIT - III

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking

UNIT - IV

Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.

UNIT - V

Application Layer: Domain name system, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

TEXT BOOK:

1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 6th Edition. Pearson Education

REFERENCE BOOKS:

1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

22IT3261: JAVA PROGRAMMING
(Open Elective – I)

	L	T	P	C
B.Tech III Year II Semester	3	-	-	**3**

Prerequisites:

• Fundamental knowledge of object-oriented concepts, terminology, and syntax, and the steps required to create basic Java programs.

• This course requires are familiar with programming language such as C/C++ and data structures, algorithms.

Course Objectives:

• To understand object-oriented programming concepts, and apply them in solving problems.
• To introduce the implementation of packages and interfaces.
• To introduce the concepts of exception handling and multi-threading.
• To use the collection framework classes in to real time scenarios.
• To introduce the design of Graphical User Interface using applets and swing controls.

Course Outcomes:

• Able to solve real world problems using OOP techniques.
• Able to understand the use of inheritance, abstract classes, interfaces.
• Able to solve problems using java I/O streams and handling of Exceptions.
• Able to use Collection Framework and develop multi-threaded applications.
• Able to develop applets for web applications.

UNIT- I

Java Basics: Brief introduction to Oops concepts. Introduction to Java ,JVM Architecture, Java Buzz words, Java Tokens- Comments, Identifiers, Keywords, Separators, Data types, enumerated types, Variables, constants, Type Conversion, Operators, Control Statements, Wrapper Classes, Structure of java with simple standalone program, arrays, console input and output, formatting output, constructors, methods – static and instance, parameter passing, access control modifiers, this reference, overloading methods and constructors, recursion, garbage collection, Inner classes, exploring String and String Buffer class.

UNIT- II

Inheritance: Inheritance hierarchies, super and sub classes, super keyword, preventing inheritance: final classes and methods, the Object class and its methods. Polymorphism: Dynamic binding, static binding, method overriding, abstract classes and methods.

Interfaces: Interfaces vs. Abstract classes, defining an interface, Multiple Inheritance through interface, extending interface. Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

UNIT- III

I/O STREAM: Introduction, Byte-oriented streams, Character-oriented streams, File streams, Random-access file, Serialization. Exception handling -- Dealing with errors, benefits of exception handling, classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catches, throw, throws and finally, built in exceptions and user defined exceptions.

UNIT- IV

Multithreading: Differences between processes and threads, thread life cycle, creating threads, thread priorities, synchronizing, inter-thread communication, thread group.

Collection framework in java: Introduction, Util Package interfaces, List, Set, Map, Retrieving elements from collections, Collection interfaces: Set, Map, List, Queue. Implementation classes : ArrayList, Stack, StringTokenizer, more utilitiy classes.

UNIT-V

AWT: Introduction to AWT, Components, Event, Event-Delegation-Model, Listeners, Layout management and types – border, Grid and flow Individual components: Label, Button, Checkbox, Radio Button, Choice, List, Menu, Text Field, Text Area, Adapter classes.

Applets: Inheritance hierarchy for applets, differences between applets and applications, life cycle of an Applet, passing parameters to applets. Swings: Introduction to Swing, Swing vs. AWT, Hierarchy for Swing components.

TEXT BOOKS:

[1]. Java,The complete reference,7th edition, Herbert Schildt, TMH.
[2]. Understanding OOP with java, updated edition, T.Budd, Pearson education.

REFERENCE BOOKS:

[1]. JAVA Fundamentals- A comprehensive introduction, Herbert Schildt and Dale Skrien, TMH.
[2]. Java for Programmers, P.J.Deitel and H.M.Deitel, Pearson education.
[3]. JAVA: How to program P.J.Deitel and H.M.Deitel, PHI.

22IT3262: Object Oriented Programming using C++
(Open Elective -I)

B.Tech III Year II Semester

L	T	P	C
3	-	-	**3**

Prerequisites: A course on "Programming for Problem Solving using C".

Course Objectives:

- Introduces Object Oriented Programming concepts using the C++ language.
- Introduces the principles of data abstraction, inheritance and polymorphism.
- Introduces the principles of virtual functions and polymorphism.
- Introduces handling formatted I/O and unformatted I/O.
- Introduces exception handling.

Course Outcomes:

- To differentiate object oriented programming and procedural programming.
- To construct classes, functions and objects.
- To implement the constructors, destructors and inheritance.
- To develop programs using dynamic memory management techniques.
- To apply exception handling and generic programming.

UNIT – I

Object-Oriented Thinking: Different paradigms for problem solving, need for OOP paradigm, differences between OOP and Procedure oriented programming, Overview of OOP concepts-Abstraction, Encapsulation, Inheritance and Polymorphism.

C++ Basics: Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Pointers and Arrays, Strings, Structures, References. Flow control statement- if, switch, while, for, do, break, continue, goto statements. Functions - Scope of variables, Parameter passing, Default arguments, inline functions, Recursive functions, Pointers to functions. Dynamic memory allocation and de-allocation operators-new and delete, Preprocessor directives.

UNIT – II

C++ Classes and Data Abstraction: Class definition, Class structure, Class objects, Class scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction, ADT and information hiding.

UNIT – III

Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.

Virtual Functions and Polymorphism: Static and Dynamic binding, virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

UNIT - IV

C++ I/O: I/O using C++ functions, Stream classes hierarchy, Stream I/O, File streams and String streams, overloading operators, Error handling during file operations, Formatted I/O.

UNIT - V

Exception Handling: Benefits of exception handling, Throwing an exception, The try block, Catching an exception, Exception objects, Exception specifications, Stack unwinding, Rethrowing an exception, Catching all exceptions.

TEXT BOOKS:

1. The Complete Reference C++, 4th Edition, Herbert Schildt, Tata McGraw Hill.
2. Problem solving with C++: The Object of Programming, 4th Edition, Walter Savitch, Pearson Education.

REFERENCES:

1. The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education.
2. OOP in C++, 3rd Edition, T. Gaddis, J. Walters and G. Muganda, Wiley Dream Tech Press.
3. Object Oriented Programming in C++, 3rd Edition, R. Lafore, Galigotia Publications Pvt Ltd.

22IT4161: WEB DEVELOPMENT

L	T	P	C
3	0	0	3

(Open Elective -II)

Course Objectives:

1. To introduce XML and processing of XML Data
2. To introduce Client-side scripting with JavaScript
3. To introduce Server-side programming with Java Servlets and DataBase connection.
4. To introduce Server-side programming with JSP.
5. To introduce PHP language for server-side scripting

Course Outcomes

1. Design and develop web applications.
2. Understand what XML and how to use XML.
3. Create scripts using JavaScript in a web page.
4. Explain client side and server-side scripting and their applicability.
5. Understand server-side scripting with the PHP language

UNIT- I

HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets;

XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML.

UNIT- II

Client-side Scripting: Introduction to JavaScript, declaring variables in java script, the scope of variables, and functions. event handlers (onclick, onsubmit, etc.), Document Object Model, and Form validation

UNIT - III

Introduction to Servlets: Common Gateway Interface (CGI), the Life cycle of a Servlet, deploying a servlet, Reading Servlet parameters, Reading Initialization parameters, Handling HTTP Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC

UNIT - IV

Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Handling Cookies and sessions, connecting to database in JSP. **UNIT - V**

Introduction to PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, reading data from web form controls like text boxes, radio buttons,lists, etc., Handling sessions and cookies

File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting, etc. on the text and binary files, listing directories.

TEXTBOOKS:

1. Web Technologies, Uttam K Roy, Oxford University Press
2. The Complete Reference PHP — Steven Holzner, Tata McGraw-Hill

REFERENCE BOOKS:

[1] Web Programming, building internet applications, Chris Bates 2″ edition, Wiley Dreamtech

[2] Java Server Pages —Hans Bergsten, SPD O'Reilly,

[3] Java Script, D.Flanagan

[4] Beginning Web Programming-Jon Duckett WROX.

[5] Programming world wide web, R.W.Sebesta, Fourth Edition, Pearson.

[6] Internet and World Wide Web — How to program. Dietel and Nieto, Pearson.

22IT4162: FUNDAMENTALS OF COMPUTER NETWORKS
(Open Elective II)

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

IV B.Tech Year I Semester

Course Objectives:

- To introduce the fundamental various types of computer networks.
- To introduce the TCP/IP and OSI models with merits and demerits.
- To explore the various layers of OSI Model.
- To introduce UDP and TCP Models.
- Understand the basics of Cryptography and Network security.

Course Outcomes:
Students will be able:

- To explain the OSI Reference Model and TCP/IP Models and in particular have a good knowledge of Layers.
- To apply error correction and detection techniques of Data Link Layer.
- To identify the best routing techniques by applying algorithms of Network Layer.
- To explain the Transport Layer Protocols.
- To explain the Application Layer Protocols, Cryptography and Network security.

UNIT - I
Data Communications: Components, Direction of Data flow, Networks, Components and Categories, Types of Connections, Topologies, Protocols and Standards, ISO /OSI model.
Physical Layer: Transmission modes, Multiplexing, Transmission Media, Switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks.

UNIT - II
Data Link Layer: Introduction, Framing, Error Detection and Correction, Parity, LRC, CRC Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols.
Medium Access sub Layer: ALOHA, CSMA/CD,CSMA/CA, LAN – Ethernet IEEE 802.3, IEEE 802.5 – IEEE 802.11, Random access, Controlled access, Channelization.

UNIT - III
Network Layer: Logical Addressing, Inter-networking, Tunneling, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols.

UNIT - IV
Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services, Differentiated Services, and QoS in Switched Networks.

UNIT – V

Application Layer: Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.

TEXT BOOKS:

1. Data Communications and Networking, Behrouz A. Forouzan , Fourth Edition TMH, 2006.
2. Computer Networks, Andrew S Tanenbaum, 4th Edition. Pearson Education, PHI.

REFERENCE BOOKS:

1. Data communications and Computer Networks, P.C .Gupta, PHI.
2. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education.
3. Understanding communications and Networks, 3rd Edition, W.A. Shay, Cengage Learning.
4. Computer Networking: A Top-Down Approach Featuring the Internet. James F. Kurose & Keith W. Ross, 3 rd Edition, Pearson Education.
5. Data and Computer Communication, William Stallings, Sixth Edition, Pearson Education, 2000.

22IT4261: BIG DATA TECHNOLOGIES

(Open Elective II)

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

B.Tech IV Year II Semester

Prerequisites:

- A knowledge on Database Management Systems.

Course Objectives:

- To optimize business decisions and create competitive advantage with Big Data analytics
- To learn to analyse the big data using intelligent techniques
- To introduce programming tools PIG & HIVE in Hadoop echo system
- To manage job execution in Hadoop environment
- To develop Big Data Solutions using Hadoop Eco Sytem.

Course Outcomes:

- Illustrate big data challenges in different domains including social media, transportation, finance and medicine
- Use various techniques for mining data stream
- Design and develop Hadoop
- Identify the characteristics of datasets and compare the trivial data and big data for various applications
- Explore the various search methods and visualization techniques

UNIT I

Introduction to big data: Introduction to Big Data Platform, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs Reporting.

UNIT II

Stream Processing: Mining data streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications, Case Studies – Real Time Sentiment Analysis – Stock Market Predictions.

UNIT III

Introduction to Hadoop: Hadoop: History of Hadoop, the Hadoop Distributed File System, Components of Hadoop Analyzing the Data with Hadoop, Scaling Out, Hadoop Streaming, Design of HDFS, Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run, Failures, Job Scheduling, Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features Hadoop environment.

UNIT IV

Frameworks and Applications: Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig, Hive services, HiveQL, Querying Data in Hive, fundamentals of HBase and ZooKeeper.

UNIT V

Predictive Analytics and Visualizations: Predictive Analytics, Simple linear regression, multiple linear regression, Interpretation of regression coefficients, Visualizations, Visual data analysis techniques, interaction techniques, Systems and application

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'reilly Media, Fourth Edition, 2015.
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.
3. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP, 2012

References:

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.
2. Paul Zikopoulos, DirkdeRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, "Harness the Power of Big Data: The IBM Big Data Platform", Tata McGraw Hill Publications, 2012.
3. Arshdeep Bahga and Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach ", VPT, 2016.

22IT4262: FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY
(Open Elective III)

B.Tech IV Year II Semester

L	T	P	C
3	-	-	**3**

Pre-requisites:

- Knowledge in Computer Networks
- Knowledge in Distributed Databases.

Course Objectives:

- Impart strong technical understanding of Blockchain technologies.
- Gain knowledge about applications of cryptography in Blockchain.
- Learn about the concepts of various implementations of Blockchain technology such as Bit coin, Ethereum and Hyper ledger.
- Understand the modern currencies and their market usage.
- Introduce application areas, current practices and research activity.

Course Outcomes: After the completion of the course student should be able to

- Learn fundamentals of Blockchain techniques.
- Analyze various consensus problems.
- Adapt Bitcoin technology to improve usage.
- Make use of Ethereum frameworks to write smart contract.
- Interpret Blockchain technology in real time applications.

UNIT I

Introduction: What is Blockchain, The history of block chain, Benefits and limitations of Blockchain, Distributed systems, Decentralization using block chain, CAP theorem and block chain, Crowd funding.

UNIT II

Cryptography in Blockchain: Crypto currency, How a Crypto currency works, cryptographic primitives, Asymmetric cryptography, public and private keys, line interface, Bitcoin improvement proposals (BIPs) , Consensus Algorithms, Digital Identity verification, Blockchain Neutrality, Digital art.

UNIT III

Bitcoin: The Bitcoin network, Wallets and its types, Bitcoin payments, Bitcoin investment and buying and selling bit coins, Bitcoin installation, Bitcoin programming and the command line interface, Bitcoin improvement proposals (BIPs).
Blockchain Science: Grid coin, Folding coin, Blockchain Genomics

UNIT IV

Ethereum: Ethereum Virtual Machine (EVM), Wallets for Ethereum, Solidity, Smart Contracts, Some Attacks on Smart Contracts, The Ethereum network, Applications developed on Ethereum, Scalability and security issues.

UNIT V

Issues in Blockchain: Technical challenges, Business model challenges, Government Regulations, Zero Knowledge proofs and protocols in Blockchain

Introduction to Hyperledger: - Hyperledger as a protocol, Fabric, Hyper ledger Fabric, Saw tooth Lake, Corda Architecture.

Text Books:

1. Blockchain Blue print for Economy by Melanie Swan.
2. I. Bashir, Mastering Block chain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd revised edition. Birmingham: Packt Publishing, 2018.

References:

1. Vigna, Paul, and Michael J. Casey. The Truth Machine: The Block chain and the Future of Everything. Picador, 2019.
2. Gerard, David. Attack of the 50 foot block chain: Bitcoin, block chain, Ethereum & smart contracts. David Gerard, 2017.
3. Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang, "An Overview of Block chain Technology: Architecture, Consensus, and Future Trends," in 2017 IEEE International Congress on Big Data (Big Data Congress), 2017, pp.557–564.

22BU3261 - ENTERPRISE RESOURCE PLANNING

(Open Elective I)

L	T	P	C
3	-	-	3

Course Objectives:

1. To provide a contemporary and forward-looking view on the theory and practice of Enterprise Resource Planning Technology.
2. To focus on Business Process Reengineering.
3. To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
4. To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
5. To aim at preparing the students technologically competitive and make them ready to self- upgrade with the higher technical skills.

Course Outcomes:

1. Make basic use of Enterprise software, and its role in integrating business functions
2. Analyze the strategic options for ERP identification and adoption.
3. Design the ERP implementation strategies.
4. Create reengineered business processes for successful ERP implementation.
5. Integration of ERP into organization culture

UNIT - I

ERP Introduction, Origin, Evolution and Structure: Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP. Integrated Data Model. Scope – Technology – Benefits of ERP: Reduction in cycle Time, Lead Time & Cost, Improved Resource Utilization, Supplier Performance. Flexibility, Accuracy & Decision Making, Customer Satisfaction & On-time Shipment.

UNIT - II

Business Process Reengineering, Management Information system, Decision Support System, Executive Information System. Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Management (PLM), LAP, Supply chain Management.

UNIT - III

ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP-Modules: Functional Modules, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications, Manufacturing and logistics modules.

UNIT – IV

ERP Implementation: Implementation Life Cycle -Implementation Methodology - Hidden Costs - Organizing Implementation - Vendors, Consultants and Users Contracts-Project Management and Monitoring- Role of SDLC/SSAD.

UNIT - V

ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into organizational culture.

TEXT BOOKS:

1.Vinod Kumar Garg and Venkita Krishnan N K, “Enterprise Resource Planning Concepts and Practice”, PHI.

2.Joseph A Brady, Ellen F Monk, Bret Wagner, “Concepts in Enterprise Resource Planning", Thompson Course Technology.

REFERENCE BOOKS:

1.Alexis Leon, “ERP Demystified”, Tata McGraw Hill
2.Rahul V. Altekar “Enterprise Resource Planning”, Tata McGraw Hill
3.Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise Resource Planning – A Concepts and Practice”, PHI Mary Summer, “Enterprise Resource Planning”- Pearson Education

22BU3262 - CLOUD COMPUTING

(Open Elective I)

L	T	P	C
3	-	-	3

Pre-requisites:

1. A course on "Computer Networks".
2. A course on "Operating System".

Course Objectives:

- To explain the evolving computer model called cloud computing.
- To Understand the current trend and basics technologies of cloud computing
- To introduce the various levels of services that can be achieved by cloud to develop applications.
- To describe the Networking aspects in cloud
- To describe the security aspects in cloud.

Course Outcomes:

- Understand different computing paradigms and potential of the paradigms and specifically Cloud computing
- Understand cloud service types, cloud deployment models and technologies supporting and driving the cloud
- Acquire the knowledge of programming models for cloud and development of software application that runs the cloud and various services available from major cloud providers
- Understand the security concerns and issues in cloud computing
- Acquire the knowledge of advances in cloud computing.

UNIT - I

Computing Paradigms, Cloud Computing Fundamentals, Cloud Computing Architecture and Management

UNIT - II

Cloud Deployment Models, Cloud Service Models, Technological Drivers for Cloud Computing:SOA and Cloud, Multicore Technology, Web 2.0 and Web 3.0, Pervasive Computing, Operating System, Application Environment

UNIT - III

Virtualization, Programming Models for Cloud Computing: MapReduce, Cloud Haskell, Software Development in Cloud

UNIT – IV

Networking for Cloud Computing: Introduction, Overview of Data Center Environment, Networking Isses in Data Centers, Transport Layer Issues in DCNs, Cloud Service Providers

UNIT - V

Security in Cloud Computing, and Advanced Concepts in Cloud Computing

TEXT BOOK:

1. Chandrasekaran, K. Essentials of cloud computing. CRC Press, 2014

REFERENCE BOOKS:

1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
2. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010
3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

22CY3261: Introduction to Cyber Security
(Open Elective-I)

B.Tech. III Year I Sem. **L T P C**
3 - - 3

Prerequisites: Course on Computer Networks.

Course objectives:

1. To understand various types of cyber-attacks and cyber-crimes
2. To understand intrusion detection system
3. To learn threats and risks within context of the cyber security
4. To have an overview of the cyber laws & concepts of cyber forensics
5. To study the defensive techniques against these attacks

Course Outcomes:

1. Analyze and evaluate the cyber security needs of an organization.
2. Understand Cyber Security Regulations and Roles of International Law and Learn, analyze and validate Forensics Data
3. Understand web threats, security and privacy implications of an organization.
4. Design and develop a security architecture for an organization.
5. Understand fundamental concepts of data privacy attacks and policies.

Unit I:

Introduction to Cyber Security:

Introduction to Cyber Space, Introduction to Information Systems, Need for Cyber Security

Cyber Attacks:

Introduction to Cyber Attacks, Classification of Cyber Attacks, Classification of Malware, Threats, Vulnerability Assessment.

Unit II:

Cyberspace and the Law & Cyber Forensics:

Intrusion Detection Systems,I ntrusion Prevention Systems,Introduction to User Authentication Methods, Biometric Authentication Methods, Biometric Systems.

Cyber Law-Basics:

Cyber Law-Basics, Information Technology Act 2000,Amendments to IT Act 2000.

Unit III:

Security Models and Security Mechanisms:

Different Security Models and Security Mechanisms, Information Security and Network Security, Operating System Security, Web Security,Email Security,Mobile Device Security, Cloud Security, IoT Security, Cyber Physical System Security, Social Media Security,Virtual Currency,Block Chain Technology, Security Auditing.

Unit IV:

Cyber Crimes: Introduction to Cyber Crimes, Different Types of Cyber Crimes, Scams and Frauds, Analysis of Crimes, Human Behavior, Stylometry, Incident Handling, Investigation Methods, Criminal Profiling, Cyber Trails.

Unit V:

Digital Forensics:

Digital Forensics, History, Challenges, Branches of Digital Forensics, Digital Forensic Investigation Methods, Reporting, Management of Evidence

Note: A Value Added Program (VAP) to be offered in the same area through MOOCS*

SUGGESTED BOOKS AND REFERENCES

1. Cyber Security- Understanding Cyber Crimes Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belapure [Units-I/II/III/IV]
2. Computer security principles and practices - William stallings and Lawrie Brown[Units-I/II/IV/V]
3. Principles of information security – Michael[Unit-I]
4. Incident Responce & Computer forensics - Jason Luttgens, Mathew Pepe and Kevin Mandia[Unit-IV]
5. Digital forensics for Legal Professionals: Understanding Digital Evidence from the Warrant to the Courtroom - Lars E.Daniel and Paul R.Reddy[Unit-V]

Web references:

1. https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf
2. http://larose.staff.ub.ac.id/files/2011/12/Cyber-Criminology-Exploring-Internet-Crimes-and-Criminal-Behavior.pdf
3. http://docshare04.docshare.tips/files/21900/219006870.pdf
4. http://index-of.co.uk/Hacking- Colecion/Insider%20Attack%20&%20Cyber%20Security%20-%20Beyond%20the%20Hacker.pdf
5. http://www.uou.ac.in/sites/default/files/slm/FCS.pdf
6. https://cyber-cops.com/book_detail

22CY3262: ETHICAL HACKING

(Open Elective – I)

B.Tech. III Year II Sem. **L T P C**

3 - - 3

Prerequisites: courses on Operating Systems, Computer Networks, Network Security and Cryptography.

Course Objectives:

1. The aim of the course is to introduce the methodologies and framework of ethical hacking for enhancing the security.
2. Provides Insights on Impacts of Hacking
3. Overview on Types of Hackers; Information Security Models; Information Security Program.
4. Business Perspective, Planning a Controlled Attack.
5. Framework of Steps (Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Deliverable and Integration)

Course Outcomes:

1. Understand what is right and what is wrong in the world of hacking.
2. Gain the knowledge of the use and availability of tools to support an ethical hack 3. Gain the knowledge of interpreting the results of a controlled attack
4. Understand the role of politics, inherent and imposed limitations and metrics for planning of a test
5. Comprehend the dangers associated with penetration testing

UNIT- I

Introduction: Hacking Impacts, The Hacker

Framework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration.

Information Security Models: Computer Security, Network Security, Service Security, Application Security, Security Architecture

Information Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking.

UNIT - II

The Business Perspective: Business Objectives, Security Policy, Previous Test Results, Business Challenges.

Planning for a Controlled Attack: Inherent Limitations, Imposed Limitations, timing is

Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement.

UNIT - III

Preparing for a Hack: Technical Preparation, Managing the Engagement.

Reconnaissance: Social Engineering, Physical Security, Internet Reconnaissance.

UNIT - IV

Enumeration: Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase.

Exploitation: Intutive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, RootKits, applications, Wardialing, Network, Services and Areas of Concern.

UNIT - V

Deliverable: The Deliverable, The Document, Overall Structure, Aligning Findings, Presentation.

Integration: Integrating the Results, Integration Summary, Mitigation, Defense Planning, Incident Management, Security Policy, Conclusion.

TEXT BOOK:

1. James S. Tiller, "The Ethical Hack: A Framework for Business Value Penetration Testing", Auerbach Publications, CRC Press.
2. Michael Simpson, Kent Backman, James Corley, "Hands-On Ethical Hacking and Network, Defense", Cengage Learning.

REFERENCE BOOKS:

1. EC-Council, "Ethical Hacking and Countermeasures Attack Phases", Cengage Learning.

22CY4161: COMPUTER SECURITY & AUDIT ASSURANCE

(Open Elective - II)

B.Tech. IV Year I Sem. **L T P C**
3 - - 3

Prerequisites: Computer Networks, network security

Course Objectives:

1. State the basic concepts in information systems security.
2. Insights on security technology and principles
3. Insights on software security and trusted systems
4. Insights on security management.
5. Explain concepts related to various cryptographic tools.

Course Outcomes:

1. State the requirements and mechanisms for identification and authentication.
2. Explain and compare the various access control policies and models as well as the assurance of these models.
3. Understand various standard practices and policies in conducting audits.
4. Understand and analyze the significance of Network Security and Control
5. Understand and analyze Internet Banking Risks and Control.

UNIT - I

System Audit and Assurance – Characteristics of Assurance services, Types of Assurances services, Certified Information system auditor, Benefits of Audits for Organization, COBIT.

UNIT - II

Internal Control and Information system Audit - Internal Control, Detective control, Corrective Control, Computer Assisted Audit Tools and Techniques.

UNIT - III

Conducting Audit – Standard practices, policies, Audit planning, Risk Assessment, Information gathering techniques, Vulnerabilities, System security testing, conducting Audits for Banks.

UNIT - IV

Network Security and Control, Internet Banking Risks and Control, Operating System Risks and Control, Operational Control Overview.

UNIT - V

Business Continuity and Disaster Recovery Planning Control – Data backup/storage, developing appropriate Disaster recovering strategy, Business Impact analysis.

TEXT BOOK:

1. Information System Audit and Assurance; D. P. Dube, Ved Prakash Gulati; Tata McGraw- Hill Education, 01 Jan 2005.
2. 1. William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Pearson education

REFERENCE BOOKS:

1. Martin Weiss and Michael G. Solomon, Auditing IT Infrastructures For Compliance (Information Systems Security & Assurance)**,** Jones and Bartlett Publishers, Inc.

22CY4162: SOCIAL MEDIA SECURITY

(Open Elective – II)

B.Tech. IV Year I Sem. **L T P C**

3 - - 3

Prerequisites: knowledge of computer networks, operating system

Course Objectives:

1. Give introduction about the social networks, its use, the need of security in social data.
2. Insights on cybercrime.
3. Insights on Value of social media, Cutting Edge Versus Bleeding Edge
4. Provide insights on risks of social media with respect to public embarrassment.
5. Policies and Privacy Blocking users controlling app privacy.

Course Outcomes:

1. Learn about browser's risks.
2. Learn about Social Networking, Understand the risks while using social media. Guidelines for social networking.
3. Understand how to secure different web browsers.
4. Understand how an e-mail works.
5. learn threats involved using an email communication, safety measures while using e-mail.

UNIT – I

Introduction to Social Media, Understanding Social Media, Different Types and Classifications, The Value of Social Media, Cutting Edge Versus Bleeding Edge, The Problems That Come With Social Media, Is Security Really an Issue? Taking the Good With the Bad.

UNIT - II

Dark side Cybercrime, Social Engineering, Hacked accounts, cyberstalking, cyberbullying, predators, phishing, hackers.

UNIT – III

Being bold versus being overlooked Good social media campaigns, Bad social media campaigns, Sometimes it's better to be overlooked, Social media hoaxes, The human factor, Content management, Promotion of social media.

UNIT - IV

Risks of Social media Introduction Public embarrassment, Once it's out there, it's out there False information, Information leakage, Retention and archiving, Loss of data and equipment.

UNIT – V

Policies and Privacy Blocking users controlling app privacy, Location awareness, Security Fake accounts passwords, privacy and information sharing.

TEXT BOOKS:

- Interdisciplinary Impact Analysis of Privacy in Social Networks, Recognizing Your Digital Friends, Encryption for Peer-to-Peer Social Networks Crowd sourcing and Ethics, Authors: Altshuler Y, EloviciY, Cremers A.B, Aharony N, Pentland A. (Eds.).
- Social media security
  https://www.sciencedirect.com/science/article/pii/B97815974998660000

REFERENCE BOOKS:

- Michael Cross, Social Media Security Leveraging Social Networking While Mitigating Risk.
- Online Social Networks Security, Brij B. Gupta, Somya Ranjan Sahoo, Principles, Algorithm, Applications, and Perspectives, CRC press.

22AM3261: MACHINE LEARNING

(OPEN ELECTIVE - I)

B.Tech. III Year II Sem. **L T P C**

3 - - 3

Prerequisites:

- Statistics
- Linear Algebra
- Calculus
- Probability
- Programming Languages and data structures.

Course Objectives: The course will explain

- The basic theory underlying machine learning.
- Machine learning problems corresponding to different applications.
- A range of machine learning algorithms along with their strengths and weaknesses.
- Machine learning algorithms to solve problems of moderate complexity.
- The algorithms to a real-world problem, optimize the models learned and report on theexpected accuracy that can be achieved by applying the models..

Course Outcomes: At the end of the course, the student will be able to

- Appreciate the importance of visualization in the data analytics solution.
- Apply structured thinking to unstructured problems.
- Understand a very broad collection of machine learning algorithms and problems.
- Learn algorithmic topics of machine learning and mathematically deep enough to introducethe required theory.
- Develop an appreciation for what is involved in learning from data**.**

UNIT-I

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning

Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidateeliminationalgorithm,remarksonversionspacesandcandidate elimination, inductive bias, Gradient Descent Algorithm and its variants.

UNIT–II

Supervised Learning- Regression: Linear-Simple, Multiple, Logistic Regression. Classification- Naive Bayes Classifier, k-NN classifier, Support Vector Machines - Linear, NonLinear Ensemble Techniques I-Decision Trees-ID3 (Iterative Dichotomiser3), CART (Classification andRegression Tree)

UNIT–III

Ensemble Techniques II- C4.5, CHAID (Chi-Square Automatic Interaction Detection), random forest Algorithm.

Unsupervised Learning-Clustering: Measures of distance, k-means, Gaussian Mixture ModelClustering, Hierarchical Learning- Divisive, Agglomerative Clustering

UNIT-IV

Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.

Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

UNIT-V

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

Reinforcement Learning–Introduction, the learning task, *Q*–learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

TEXT BOOKS:

1. Machine Learning –Tom M. Mitchell,-MGH, 2020.
2. Introduction to Machine Learning with Python, **Author –** Andreas C. Müller, Sarah Guido, **Edition –** First Edition, **Publisher –** O'Reilly Media, Inc, 2016.

REFERENCE BOOKS:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.
2. Mathematics for Machine learning, **Author –** Marc Peter Deisenroth, **Edition –** First Edition, **Publisher –** Cambridge University Press.

22AM3262: ARTIFICIAL INTELLIGENCE

(OPEN ELECTIVE - I)

B. Tech III Year II Sem. **L T P C**

3 - - 3

COURSE OBJECTIVES: Develop ability to:

1. Understand the difference between various intelligent agents and environments including solving problems by searching the solution space.

2. Understand adversarial search and propositional logic to find the solutions of constraint satisfaction problems.

3. Reference using first order logic and describe knowledge representation

4. Design solutions to a problem in the real world environment

5. Learn to infer in uncertain domains using probabilistic learning models.

COURSE OUTCOMES: At the end of the course, the student will be able to:

1. Differentiate various intelligent agents and environments and also solve problems by searching the solution space.
2. Use adversarial search and propositional logic to solve constraint satisfaction problems
3. Use first order logic to infer and describe knowledge representation
4. Plan solutions for problems in the real world environment.
5. Infer in uncertain domains using probabilistic learning models

UNIT - I:

Problem Solving by Search-I & II Introduction to AI, Intelligent Agents, Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bidirectional search, Informed (Heuristic) Search Strategies: Greedy best-first search, A* search, Heuristic Functions, Beyond Classical Search: Hill-climbing search, Simulated annealing search.

UNIT – II

Adversarial Search: Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions. Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, the Structure of Problems. Propositional Logic: Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite

clauses, Forward and backward chaining, Effective Propositional Model Checking, Agents Based on Propositional Logic

UNIT - III:

Logic and Knowledge Representation First-Order Logic: Representation, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution. Knowledge Representation: Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

UNIT - IV:

Planning Classical Planning: Definition of Classical Planning, Algorithms for Planning with State-Space Search, Planning Graphs, other Classical Planning Approaches, and Analysis of Planning approaches. Planning and Acting in the Real World: Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent planning,

UNIT - V:

Approaches to Uncertain Reasoning; Dempster-Shafer theory. Learning: Forms of Learning, Knowledge in Learning: Logical Formulation of Learning, the Semantics of Bayesian Networks.

TEXT BOOK:

1. Artificial Intelligence a Modern Approach, Stuart Russell and Peter Norvig, 4th Edition, Pearson Education, 2020.

REFERENCE BOOKS:

1. Artificial Intelligence, E. Rich and K. Knight,, 3rd Edition, TMH, 2009.

2. Artificial Intelligence, Patrick Henny Winston, 3rd Edition, Pearson Education, 2015.

3. Artificial Intelligence, Shivani Goel, Pearson Education, 2013. .

4. Artificial Intelligence and Expert systems – Patterson, Pearson Education, 2005

22DS3261: FUNDAMENTALS OF DATA SCIENCE

(OPEN ELECTIVE - I)

B.Tech. III Year II Sem

L	T	P	C
3	-	-	3

Prerequisites:

- A Course on Computer Oriented Statistical Methods.
- Basic Knowledge on Programming languages.

Course Objectives:

- Learn the Basic Skill sets needed for a Data Science with Basics of R Programming
- Learn the control and conditional statements.
- An overview of simple statistical models and the basics of machine learning techniques.
- Learn the R concepts of vectors, matrices, factors and data frames.
- Identify the importance of Data Reduction and Data Visualization Techniques.

Course Outcomes: After completion of the course, the student should be able to

- Describe what Data Science is and the skill sets needed to be a data scientist, Basics of R
- Understand the conditional and control statements, Functions and Loading of a package using R
- Describe the data using various statistical Measures.
- Understand the concepts of Vectors, Matrices, Factors and Data Frames using R.
- Perform Data Reduction and apply visualize techniques.

UNIT I:

Introduction: Definition of Data Science- Big Data and Data Science hype – and getting past the hype - Datafication- Current landscape of perspectives - Statistical Inference - Populations and samples – Statistical modeling, probability distributions, fitting a model – Over fitting.
Basics of R: Introduction, R-Environment Setup, Programming with R, Basic Data Types

UNIT II:

Data Types & Statistical Description Types of Data: Attributes and Measurement, Attribute, The Type of an Attribute, The Different Types of Attributes, Describing Attributes by the Number of Values, Asymmetric Attributes, Binary Attribute, Nominal Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes.
Basic Statistical Descriptions of Data: Measuring the Central Tendency: Mean, Median, and Mode, Measuring the Dispersion of Data: Range, Quartiles, Variance, Standard Deviation, and Interquartile Range, Graphic Displays of Basic Statistical Descriptions of Data.

UNIT III:

Vectors: Creating and Naming Vectors, Vector Arithmetic, Vector sub setting,
Matrices: Creating and Naming Matrices, Matrix Sub setting, Arrays, Class.Factors and Data Frames: Introduction to Factors: Factor Levels, Summarizing a Factor, Ordered Factors, Comparing Ordered

Factors, Introduction to Data Frame, subsetting of Data Frames, Extending Data Frames, Sorting Data Frames. Lists: Introduction, creating a List: Creating a Named List, Accessing List Elements, Manipulating List Elements, Merging Lists, Converting Lists to Vectors

UNIT IV:

Conditionals and Control Flow: Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements.

Iterative Programming in R: Introduction, While Loop, For Loop, Looping Over List.

Functions in R: Introduction, writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R.

UNIT V:

Charts and Graphs: Introduction, Pie Chart: Chart Legend, Bar Chart, Box Plot, Histogram, Line Graph: Multiple Lines in Line Graph, Scatter Plot.

Regression: Linear Regression Analysis, Multiple Linear regression

TEXT BOOKS:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014.

2. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:

1. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed. The Morgan Kaufmann Series in Data Management Systems.

2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.

3. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, 4 LLC, 2014.

4. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.

5. Paul Teetor, "R Cookbook", O'Reilly, 2011.

22DS3262: R PROGRAMMING

(OPEN ELECTIVE – I)

B.Tech. III Year II Sem

L	T	P	C
2	1	-	3

Prerequisites:

- Basic Knowledge on Programming languages.

Course Objectives:

- Understanding and being able to use basic programming concepts
- Automate data analysis
- Working collaboratively and openly on code
- Knowing how to generate dynamic documents
- Being able to use a continuous test-driven development approach

Course Outcomes:

- Understand to use and program in the programming language R
- Understand to use R to solve statistical problems
- Implement and describe Monte Carlo the technology
- Implement minimize and maximize functions using R
- Apply various concepts to write programs in R

UNIT – I

Introduction: Overview of R, R data types and objects, reading and writing data, sub setting, R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations.

UNIT – II

Conditionals and Control Flow: Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements. Iterative Programming in R: Introduction, While Loop, For Loop, Looping Over List. Functions in R: Introduction, writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R.

UNIT – III

Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List, Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List, Components and Values Applying Functions to Lists, DATA FRAMES, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations.

UNIT - IV

Factors and Tables: Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables, Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions.

UNIT - V

Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

TEXT BOOKS:

1. R Programming for Data Science by Roger D. Peng
2. The Art of R Programming by Norman Matloff Cengage Learning India.
3. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014
4. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

REFERENCE BOOKS:

1. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data 1st Edition, O'Reilly.
2. Tilman M. Davies, The book of R a first course in programming and statistics, no starch press.

22DS4161: DATA MINING

(OPEN ELECTIVE – II)

B.Tech. IV Year I Sem

L	T	P	C
3	-	-	3

Pre-Requisites:

- Database Management System
- Probability and Statistics

Course Objectives:

- Students will become acquainted with both the strengths and limitations of various data mining techniques like Association, Classification, Cluster and Outlier analysis.
- To describe the concepts related to data warehousing,
- To understand stages in building a Data Mining.
- To analyze classification algorithms and evaluate prediction techniques.
- To describe methods for data-clustering approaches

Course Outcomes:

- Understand the need of data mining and pre-processing techniques.
- Perform market basket analysis using association rule mining.
- Utilize classification techniques for analysis and interpretation of data.
- Identify appropriate clustering and outlier detection techniques to handle complex data.
- Understand the mining of data from web, text and time series data.

UNIT - I

Introduction to Data Mining: What Data mining? Kinds of Data, Knowledge Discovery process, Data Mining Functionalities, Kinds of Patterns, Major Issues in Data Mining. Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity,

Data Pre-processing: Major Tasks in Data Pre-processing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization**.**

UNIT - II

Association Analysis: Basic Concepts, Market Basket Analysis, Apriori Algorithm, FP-growth, From Association Analysis to Correlation Analysis, Pattern Mining in Multilevel Associations and Multidimensional Associations.

UNIT - III

Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Metrics for Evaluating Classifier Performance, Ensemble Methods, Multilayer Feed Forward Neural Network, Support Vector Machines, k-Nearest-Neighbor Classifiers.

UNIT - IV

Cluster Analysis: Requirements for Cluster Analysis, Overview of Basic Clustering Methods, Partitioning Methods-k-Means, k-Medoids, Hierarchical Methods-AGENES, DIANA, BIRCH, Density Based Method-DBSCAN, Outlier Analysis: Types of Outliers, Challenges of Outlier Detection, and Overview of Outlier Detection Methods.

UNIT - V

Advanced Concepts: Web Mining- Web Content Mining, Web Structure Mining, Web Usage Mining, Spatial Mining- Spatial Data Overview, Spatial Data Mining Primitives, Spatial Rules, Spatial Classification Algorithm, Spatial Clustering Algorithms, Temporal Mining- Modeling Temporal Events,Time Series, Pattern Detection, Sequences, Temporal Association Rules.

TEXT BOOKS:

1. Jiawei Han, Micheline Kamber, Jian Pei., Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann/Elsevier, 2012.

2. Margaret H Dunham, Data Mining Introductory and Advanced Topics, 2nd Edition, Pearson Education, India, 2006.

REFERENCE BOOKS:

1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.

2. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne and Vipin Kumar, Introduction to Data Mining, 2nd Edition, Pearson Education India, 2021.

3. Amitesh Sinha, Data Warehousing, Thomson Learning, India, 2007.

22DS4162: DATA ANALYTICS

(OPEN ELECTIVE – II)

B.Tech. IV Year I Sem

L	T	P	C
3	-	-	3

Prerequisites

- A course on "Database Management Systems".
- Knowledge of probability and statistics.

Course Objectives:

- To explore the fundamental concepts of data analytics.
- To learn the principles and methods of statistical analysis
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.
- Explore knowledge on various segmentation techniques.
- To understand the various search methods and visualization techniques.

Course Outcomes: After completion of this course students will be able to

- Understand the impact of data analytics for business decisions and strategy
- Carry out data analysis/statistical analysis
- To carry out standard data visualization and formal inference procedures.
- Design Data Architecture.
- Understand various Data Sources.

UNIT - I

Data Management: Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality (noise, outliers, missing values, duplicate data) and Data Processing & Processing.

UNIT - II

Data Analytics: Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and Variables, Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

UNIT - III

Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc.

Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

UNIT - IV

Object Segmentation: Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc. Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyze for prediction.

UNIT - V

Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

TEXT BOOKS:

1. Student's Handbook for Associate Analytics – II, III.
2. Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers.

REFERENCE BOOKS:

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006.
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira
3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Milliway Labs Jeffrey D Ullman Stanford Univ.

22DS4261: INTRODUCTION TO SOCIAL MEDIA MINING

(OPEN ELECTIVE – III)

B.Tech. IV Year II Sem

L	T	P	C
3	-	-	3

Prerequisites

- Data Analytics.

Course Objectives

- TThe purpose of this course is to provide the students with knowledge of social media mining principles and techniques.
- This course is also designed to give an exposure of the frontiers of social media mining (Facebook, twitter)
- To introduce new technology for data analytics and introduce community Analysis
- To introduce various Recommendation algorithms
- Insights on Diffusions, Cascades and Measuring Assortativity

Course Outcomes

- Understand social media and its data.
- Apply mining technologies on twitter, Facebook, LinkedIn and Google.
- Learn about community
- Apply various Recommendation Algorithms
- Analyze the Behavior of people

UNIT - I

Introduction Social Media Mining, New Challenges for Mining Graph Essentials Graph Basics, Graph Representation, Types of Graphs, Connectivity in Graphs, Special Graphs, Graph Algorithms.

UNIT - II

Network Measures Centrality, Transitivity and Reciprocity, Balance and Status, Similarity.

Network Models Properties of Real-World Networks, Random Graphs, Small-World Model, Preferential Attachment Model.

UNIT - III

Data Mining Essentials Data, Data Preprocessing, Data Mining Algorithms, Supervised Learning, Unsupervised Learning Community Analysis Community Detection, Community Evaluation, Community Evaluation.

UNIT - IV

Information Diffusion in Social Media Herd Behavior, Information Cascades, Diffusion of innovations, Epidemics Influence and Homophily Measuring Assortativity, Influence, Homophily, Distinguishing Influence and Homophily.

UNIT - V

Recommendation in Social Media Challenges, Classical Recommendation Algorithms, Recommendation Using Social Context, Evaluating Recommendations Behavior Analytics
Individual Behavior, Collective Behavior.

TEXT BOOK:

1. Social Media Mining (An Introduction), Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, Cambridge University Press, Draft Version: April 20, 2014

REFERENCE BOOKS:

1. Mining the Social Web, 2nd Edition Data Mining Face book, Twitter, LinkedIn, Google+, GitHub, and More By Matthew A. Russell Publisher: O'Reilly Media.
3. Social Media Mining with R [Kindle Edition] NATHAN DANNEMAN RICHARD HEIMANN.

22DS4262: DATA VISUALIZATION USING PYTHON

(OPEN ELECTIVE – III)

B.Tech. IV Year II Sem

L	T	P	C
3	-	-	3

Course Objectives:

- Learn data wrangling techniques
- Introduce visual perception and core skills for visual analysis.
- Analyze on the seaborn library, Altair's declarative API.
- Explore on Plotly and insights on the various charts using Plotly.
- Gain knowledge on CGPlot2/Plotnin

Course Outcomes:

- Perform data wrangling
- Explain principles of visual perception
- Apply core skills for visual analysis
- Apply visualization techniques for various data analysis tasks
- Evaluate visualization techniques

UNIT - I

An Introduction to Data Visualization in Python, Types of Plots- statistical plots, Images, Networks/Graphs, Geographical, 3D and Interactive, Grids and Meshes.

UNIT - II

Manipulating and visualizing data with Pandas: defining data frames, Creating and manipulating data frames, visualization with pandas

Matplotlib: Features of matplotlib, Anatomy and Customization of matplotlib plot, Plotting and plot customization, Customizing a plot, Visualization examples.

UNIT - III

Seaborn: Features of seaborn, Creating plots with seaborn, Visualization examples

Altair: Altair's declarative API, creating an Altair Chart and Plot, Changing mark/Plot Types, Global Configuration, Encoding arguments, Altair Data types, Creating Titles, Properties, Tooltips, Saving Altair Charts, Making Plots Interactive, Visualization Examples,

UNIT - IV

Plotly: Plotly and JSON, Online and Offline plotting, Structure of Plotly Plot, Graph Objectives VS Dictionaries, Plotly Express, updating plots- Adding and Updating Traces, Creating Subplots, DropDown Menus, Dash Interactivity, Example Plots

UNIT - V

CGPlot2/Plotnine: The Gammar of Graphics, Creating Plots, Changing Geoms, Stats, Faceting, Coordinates, Annotations, Scaling, Themes, Legends, and Palettes, Visualization Examples.

TEXT BOOKS:

1. Daniel Nelson, Data Visualization in Python

2. Ward, Grinstein Keim, Interactive Data Visualization: Foundations, Techniques, and Applications. Natick A K Peters, Ltd.

REFERENCE BOOKS:

1. Jacqueline Kazil and Katharine Jarmul, Data Wrangling with Python: Tips and Tools to Make Your Life Easier, O'Reilly.

2. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.