LORDS INSTITUTE OF ENGINEERINGANDTECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF COMPUTER SCIENCE & ENIGINEERING ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-23]
(W.e.f Academic Year 2025-26)

B.E.V-Semester

S.No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			CREDITS
				L	T	P/D	Contact Hours/Week	Maximum Marks CIE	Maximum Marks SEE	Duration In Hour	
Theory Course											
1	U23MB501	HSMC	Business Economics and Financial Analysis	3	0	0	3	40	60	3	3
2	U23CS501	PCC	Automata Theory, Languages and Computation	3	1	0	3	40	60	3	4
3	U23CM501	PCC	Machine Learning	3	0	0	3	40	60	3	3
4	-	PEC	Professional Elective–I	3	0	0	3	40	60	3	3
5	-	OEC	Open Elective–I	3	0	0	3	40	60	3	3
Practical/Laboratory Course											
6	U23CS5L3	PCC	Scripting Languages Lab	-	-	2	2	50	-	-	1
7	U23CM5L1	PCC	Machine Learning Lab	0	0	3	3	25	50	3	1.5
Internship											
8	U21AM5P1	PROJ	Internship (During Vacation Period After IV Sem)	-	-	2	2	50	-	-	1
Skill Development Course											
9	U21MA5L1	BSC	Aptitude and Reasoning Skills Lab	-	-	2	2	25	50	-	1
Total				**15**	**0**	**10**	**25**	**325**	**450**	**-**	**20.5**

L:Lecture*(Hrs/Wk/Sem)* **T**:Tutorial*(Hrs/Wk/Sem)* **P**:Practical
D:Drawing*(Hrs/Wk/Sem)*
CIE: Continuous Internal Evaluation **SEE**: Semester End Examination **CM:**CSE-AIML
PCC: Program core course **PEC:** Professional Elective Course **PROJ**: Project
MB: Master of Business Administration **BSC**: Basic Science Courses **AM:**AI&ML
HSMC: Humanities & Social Sciences including Management Course

Note:
1. Each contact hour is a Clock Hour.
2. The duration of the practical class is three hours, however it can be extended where ever necessary to enable the student to complete the experiment.

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PROFESSIONAL ELECTIVE WITH 4 THREADS

S No.	PE1	PE2	PE3	PE4	PE5
1	Responsible and Safe AI Systems	Artificial Neural Networks	Fuzzy Logic	Optimization Techniques	Computer Vision
2	Cloud Computing	Introduction to Internet of Things	Ethical Hacking	Cognitive Computing	Modern Software Delivery with DevOps
3	Foundation Of Data Science	R- For Data Science	Mobile Computing	Privacy and Security in Online Social Media	Big Data Analytics
4	Software Engineering	Compiler Design	Computer Graphics and 3D Design & Printing	Multimedia & Animation	Virtual, Augmented and Mixed Reality

OPEN ELECTIVE COURSES OFFERED(OE-1)

U23EE508	Non Conventional Energy Systems
U23EE509	Energy Conservation and Management
U23CS508	Data Base Management Systems
U23IT506	Data Structures
U23ME509	Basics of Mechanical Engineering
U23ME510	Modern Manufacturing Processes
U23CE510	Disaster Preparedness and Management
U23CE511	Civil Engineering Principles and Practices
U23EC507	Principles of Electronic Communication
U23EC508	Semi Conductor Devices
U23MB502	Managerial Communication
U23MB503	Managerial Science and Theory
U23SH501	History of Science & Technology
U23SH502	Economic Policies in India
U23CM503	Basics of Artificial Intelligence

Course Code	Course Title						Core/Elective
U23MB501	**BUSINESS ECONOMICS AND FINANCIAL ANALYSIS**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Basic Economics	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

This course will enable students to

1. Understand the concepts of Business and Economics
2. Comprehend the concepts of market dynamics namely elasticity of demand and pricing in different market structures.
3. Gain the knowledge on the production theories and cost analysis while dealing with the production and the concept of breakeven analysis.
4. To acquire the in depth knowledge on Financial Accounting concepts and principles and preparation of final accounts.
5. To understand the financial statements through ration analysis and cash flow techniques.

Course Outcomes:

On completion of this course, the students are able to

1. Apply the concepts of business and economics during his/her professional and personal life.
2. Understand the elasticity of the demand of the product, different types, and measurement of elasticity of demand and factors influencing on elasticity of demand.
3. Recognize the Production function, features of Iso-Quants and Iso-Costs, different types of internal economies, external economies and law of returns with appropriate examples.
4. Prepare the financial statements of the firm.
5. Analyze the financial statements using ratio analysis and cash flow techniques.

UNIT – I

Introduction to Business and Economics: Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance. Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II

Demand and Supply Analysis: Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting. Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT- III

Production, Cost, and Market Structures & Pricing: Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions. Cost analysis: Types of Costs, Short run and Long run Cost Functions. Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition. Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, & Cost Volume Profit Analysis.

UNIT – IV

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of Final Accounts.

UNIT - V

Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios,

Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems), Introduction to Cash Flow Analysis (simple problems).

Suggested Reading:

1. "Managerial Economics and Financial Analysis",A.R. Aryasri, , TMH Publications, 3rd Edition, 2007.
2. "Managerial Economics", D.N. Dwivedi, Vikas Publication House Pvt. Ltd, 2nd Edition, 2012.
3. "Financial Accounting", S.N. Maheshwari & S.K.Maheshwari, , Vikas Publication House Pvt.Ltd, 4th Edition, 2012.
4. "Financial Accounting- A managerial Perspective", R. Narayana Swamy,Pearson publications, 1st Indian Reprint Edition, 2012.
5. "Managerial Economics & Financial Analysis", J.V. Prabhakar Rao & P.V. Rao, Maruthi Publishers, 1st Revised Edition, 2011.
6. "Managerial Economics and Financial Analysis", M.Kasi Reddy & Saraswathi, PHI Publications, New Delhi, 10th Revised Edition, 2012.

Course Code	Course Title						Core/Elective
U23CS501	**AUTOMATA THEORY, LANGUAGES AND COMPUTATION**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Discrete Mathematics	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives

This course will enable students to

1. Develop a formal notation for strings, languages and machines.
2. Understand Regular Expression and algebraic laws.
3. Design context free grammars and PDA, to generate strings from a context free language and Convert them into normal forms.
4. Identify the hierarchy of formal languages, grammars and machines.
5. Distinguish between computability and non-computability and Decidability and undecidability.

Course Outcomes

On completion of this course, the students are able to :

1. Gain knowledge of the various abstract machines
2. Use regular languages and regular expression for constructing different finite state machines
3. Understand and design different types of grammars
4. Construct Push down Automata
5. Construct Turing Machine.

UNIT-I

Introduction to Finite Automata, Structural Representations, Basic Concepts of Automata Theory – Symbol, Alphabets, Strings, Languages, Kleene Closure, Positive Closure

Finite Automata without Output: Deterministic Finite Automata, Nondeterministic Finite Automata, Finite Automata with Epsilon-Transitions, Conversion of NFA to DFA

UNIT-II

Regular Expressions: Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Properties of regular sets, Conversion of Finite Automata to Regular Expressions.

Pumping Lemma for Regular Languages, Statement of the pumping lemma, Applications of the Pumping Lemma.

Closure Properties of Regular Languages: Closure properties of Regular languages, Decision Properties of Regular Languages, Minimization of Automata- Equivalence, Myhill - Nerode Theorem

UNIT-III

Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Trees, Ambiguity in Grammars.

Push down Automata: Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state & empty stack, Deterministic PDA Conversion of CFG to PDA, Conversion of PDA to CFG

UNIT-IV

Normal Forms for Context- Free Grammars: Grammar Simplification, Chomsky Normal form, Greibach Normal form.

Context-Free Languages: Statement of pumping lemma, Applications pumping lemma

Properties of Context-Free Languages: Closure properties of CFL’s, Decision Properties of CFL's

UNIT-V

Turing Machines: Introduction, Techniques for construction of Turing machines, Modifications of TM, TM as enumerator, Restricted TM.

Undecidability: Recursive and Recursively enumerable languages, Halting problem, Rice Theorem, Post's correspondence problem, P,NP,NP-Complete, NP-Hard Problems, Chomsky's Hierarchy–Regular grammars, Unrestricted grammar, CSL

Suggested Reading:

1. Introduction to Automata Theory, languages, and Computation, John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Pearson Education India, 3rd Edition,2008.
2. Automata and Computability, Undergraduate Texts in Computer Science,Dexter C. Kozen, Springer, 2007.
3. Introduction to the Theory of Computation, Michael Sipser, PWS Publishing 3rd Edition,2014.
4. Introduction to Languages and the Theory of Computation, John Martin, Tata McGraw Hill, 3rd Edition,2002.

Course Code	Course Title						Core/Elective
U23CM501	**MACHINE LEARNING**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Artificial Intelligence	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

This course will enable students to

1. To introduce students to the basic concepts of Data Science and techniques of Machine Learning.
2. To develop skills of using recent machine learning software for solving practical problems.
3. To gain experience of doing independent study and research.
4. To develop an understanding of the role of machine learning in massive scale automation.
5. To design and implement various machine learning algorithms in the range of real world applications

Course Outcomes:

On completion of this course, the students are able to :

1. Design and implement machine learning solutions of classification, regression problems.
2. Evaluate and interpret the results of the machine learning algorithms.
3. Evaluate exploratory data analysis and Data preparation and preprocessing on different datasets.
4. Calculate Statistical measurements of the given data.
5. Analyze and identify the best algorithm matches for a given dataset.

UNIT – I

Introduction: What is Machine Learning, Use Machine Learning, and Types of Machine Learning Systems: supervised, unsupervised, semi-supervised, Reinforcement Learning, Batch and Online Learning, Main Challenges of Machine Learning.

UNIT – II

Descriptive Statistics: Data representation, types of data- nominal, ordinal, interval and continuous, central tendency- calculating mean mode median, mean vs median, variability, variance, standard deviation, Mean Absolute Deviation using sample dataset, finding the percentile, interquartile range, Box Plot, Outlier, whisker, calculating correlation, covariance, causation. Exploratory data analysis, Data preparation and preprocessing, Data visualization.

UNIT – III

Regression: Introduction to Regression analysis, measure of linear relationship, Regression with stats models, Determining coefficient, meaning and significance of coefficients, coefficient calculation with least square method, Types of regression, Simple Linear Regression, Using Multiple features, Polynomial Regression, Metrics for Regression: MSE, RMSE, MAE.

UNIT – IV

Classification: Classification problem, Probability based approach, Logistic Regression- log-odd, sigmoid transformation, Metrics: Confusion Matrix, Accuracy, Error Rate, Precision, Recall, ROC curve, F1 score, and introduction to gradient descent.

UNIT – V

Non Parametric & SVM classification: About Non parametric classification, Decision Trees: Entropy, Gain ratio, Information Gain, Splitting criteria.

Ensemble Method: Introduction to Random Forest, Accuracy measure & performance

Instance based learning- Introduction, KNN algorithm, Distance measures, model building, locally weighted regression, radial basis functions, SVM classifier, hyper-plane, slack variables, geometric transformation kernel trick, kernel transformation.

Suggested Readings:

1. Machine Learning in Action, Peter Harrington, Dreamtech Press India Pvt. Ltd, 1st Edition,2012.
2. The Field Guide to Data Science ,Booz, Allen, Hamilton, Manning Publications 2nd Edition,2018.
3. Hands-On Machine Learning with Scikit-Learn and TensorFlow Aurelian Géron, ,O'Reilly Media, 3rd Edition,2017.

Course code	Course Title						Core/Elective
U23CM504	Responsible and Safe AI Systems						PE-1
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
BEE	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

This course will enable students to

1. Understand recent advancements in AI capabilities and recognize the imminent and long-term risks associated with AI systems.
2. Analyze and evaluate the principles of Responsible AI (RAI), including transparency, fairness, privacy, and safety.
3. Examine techniques for AI explainability, interpretability, and defenses against adversarial and poisoning attacks.
4. Understand the legal, ethical, and regulatory frameworks governing AI deployment across different domains and regions.
5. Gain insights from industry, academia, and government experts on current challenges and future directions in Responsible AI.

Course Outcomes:

On completion of this course, the students are able to

1. Explain key advancements and risk factors associated with modern AI and generative models.
2. Apply Responsible AI principles to evaluate AI systems for fairness, transparency, robustness, and privacy.
3. Demonstrate knowledge of AI safety techniques including adversarial defenses, model interpretability, and transparency tools.
4. Analyze the impact of regulatory frameworks such as GDPR, DPDP, and AI-specific legislation on AI development and deployment.
5. Critically engage with multi-disciplinary perspectives on AI risks and policies through discussions and case studies.

Unit 1: AI Capabilities and Risks

Advances in AI technologies and models,Imminent risks: toxicity, bias, goal misspecification, adversarial examples,Long-term risks: misuse, misgeneralization, rogue AGI,Principles of **Responsible AI:** transparency, accountability, safety, robustness, privacy, fairness, human-centered values, sustainability, interpretability,Overview of deep learning, language, and vision models
AI risks in generative models,Adversarial attacks in vision, NLP, and strategic AI systems

Unit 2: AI Safety and Explainability

Machine learning poisoning attacks including Trojans,AI safety implications for present and future systems,Explainability and transparency techniques,Mechanistic interpretability, representation engineering, model editing, and probing,Critiques and limitations of transparency in AI safety

Unit 3: Privacy, Fairness, and Regulation

Privacy and fairness issues in AI systems
Tools and metrics for measuring bias, adversarial testing, and explanation methods (LIME, SHAP, Grad-CAM),Audit mechanisms for Responsible AI,Regulatory landscape: DPDP Act (India), GDPR (EU), EU AI Act, US policies,Ethical approvals, informed consent, participatory design,Future of work and AI,Concept and challenges of Artificial General Intelligence (AGI),Instrumental convergence: power-seeking and deception in AI

Unit 4: Responsible AI Applications and Policy

Application of Responsible AI in legal, healthcare, education, and other domains, Policy issues related to AI deployment and governance

Unit 5: Industry Perspectives and Research

Panel discussions with industry practitioners, academics, and government officials, Fireside chats with AI experts, Critical discussions and analysis of recent research papers in Responsible AI

Suggested Readings:

1. **"Artificial Intelligence Safety and Security"** by Roman V. Yampolskiy
2. **"Responsible AI: A Global Policy Framework"** by Virginia Dignum
3. **"Human Compatible: Artificial Intelligence and the Problem of Control"** by Stuart Russell
4. **"The Ethics of Artificial Intelligence"** edited by Nick Bostrom and Eliezer Yudkowsky (from the Cambridge Handbook of Artificial Intelligence)

Course Code	Course Title						Core/Elective
U23CM505	**Cloud Computing**						**PE - I**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

This course will enable students to

1. This course provides an insight into cloud computing
2. Topics covered include- distributed system models, different cloud service models, service-oriented architectures, cloud programming and software environments, resource management.

Course Outcomes:

On completion of this course, the students are able to

1. Understand various service delivery models of a cloud computing architecture.
2. Understand the ways in which the cloud can be programmed and deployed.
3. Gain knowledge of cloud applications
4. Design various cloud service models
5. Explore some important cloud computing driven commercial systems

UNIT - I

Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing.

UNIT - II

Cloud Computing Fundamentals: Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Definition of Cloud computing, Cloud Computing Is a Service, Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models.

UNIT - III

Cloud Computing Architecture and Management: Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications, on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure Managing the Cloud application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

UNIT - IV

Cloud Service Models: Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.

UNIT V

Cloud Service Providers: EMC, EMC IT, Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon Simple Queue, service, Microsoft, Windows Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM, Cloud Models, IBM Smart Cloud, SAP Labs, SAP HANA Cloud.

Suggested Readings:

1. Essentials of cloud Computing: K. Chandrasekharan, CRC press, 2014
2. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
3. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
4. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp 2011.

Course Code	Course Title						Core/Elective
U23CM505	**FOUNDATION OF DATA SCIENCE**						**PE-1**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Data Base Management Systems	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

This course will enable students to

1. Provide basics knowledge of Data Science qualitative and quantitative data
2. Identify the scope and essentiality of Data ware housing and Data Mining.
3. Develop research interest towards advances in data mining.
4. Analyze the data, data science lifecycle, data collection and cleaning, exploratory data analysis and visualization
5. Statistical inference and prediction, and decision-making algorithms for respective applications.

Course Outcomes:

On completion of this course, the students are able to

1. Understand the basic concepts in data science, including real world applications
2. Understand fundament also of data and Data Mining Principles.
3. To Understand importance of qualitative data, terminologies related to Data Science.
4. Understand and Extract knowledge using data preprocessing concepts in data science.
5. Understand the basics of R Programming environment : R language, R-studio and R packages

UNIT I:

Introduction to Data Science: Data Science Definition - The Data Science Venn Diagram Terminology Types of Data: - Flavors of Data- Structured and Unstructured Data-Quantitative versus qualitative Data Four Levels of Data-Case study.

UNIT II:

Evolutionary of (Five Steps) of Data Science: - Overview of Evolutionary (Five Steps)- Explore the Data Dataset 1 - Dataset2 – Titanic Communication Data: Communication matter- Identifying effective and in effective visualizations- graphs and statistics Be-Verbal Communication.

UNIT III:

Basics of Data Mining: Importance of Data Mining, moving toward the Information Age Data Mining as the Evolution of Information Technology, What Is Data Mining, What Kinds of Data Can Be Mined, Database Data, Data Warehouses, Transactional Data, Other Kinds of Data, OLTP & Online Analytical Processing (OLAP), Graphs Database.

UNIT IV:

Identification Of Data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity: Euclidean, Jaccard's Index & Cosine Similarity **Data Pre-processing**: Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization (ETL Operations).

UNIT V:

Introduction to R Programming, getting started with R: Installation of R software and using the interface, Variables and data types, R Objects, Vectors and lists, Operations: Arithmetic, Logical and Matrix operations, Data frames, functions, Control structures, Debugging and Simulation in R.

Suggested Readings:

1. Principles of Data Science, Sinon Ozdemir, Packt Publishing Ltd,2016.
2. ."The Morgan Kaufmann Series in Data Management Systems", Han, Jiawei, MichelineKamber, andJianPei, Morgan Kaufmann, 3rdedition, 2011.
3. Practical Data Science with R , Nina Zumel, Manning Publications,1st Edition,2014.
4. Mathematical techniques and theory to succeed in data driven industries, Sinan Ozdemir Principles of Data Science, Packt PublishingLimited,2016.

Course Code	Course Title						Core/Elective
U23CM507	**SOFTWARE ENGINEERING**						**PE-1**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Programming Languages	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

This course will enable students to

1. Introduce the basic concepts of software development- processes from defining a product to shipping and maintaining that product.
2. Impart knowledge on various phases, methodologies and practices of software development.
3. Understand the importance of testing in software development and study various testing strategies and software quality metrics.
4. Understand user conceptual models and development of better specifications.
5. Improvement in design languages and reusable code.

Course Outcomes:

On completion of this course, the students are able to

1. Acquire working knowledge of alternative approaches and techniques for each phase of software development.
2. Acquire skills necessary for independently developing a complete software project.
3. Understand the process models.
4. Understand the practical challenges associated with the development of a significant software system.
5. Acquire the knowledge of testing concepts.

UNIT-I

Introduction to Software Engineering:

A generic view of Process: Software Engineering, Process Framework, CMM Process Patterns, Process Assessment.

Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, the Unified Models, Personal and Team Process Models, Process Technology.

UNIT-II

An Agile view of Process: Introduction to Agility and Agile Process, Agile Process Models.

Software Engineering Principles: SE Principles, Communication Principles, Planning Principles, Modeling Principles, Construction Principles, Deployment.

UNIT-III

Requirements Engineering: A Bridge to Design and Construction, Requirements Engineering Tasks, Initiating Requirements Engineering Process, Developing Use-Cases, Negotiating Requirements, Validating Requirements.

UNIT-IV

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design, Assessing Alternative Architectural Designs, Mapping Data Flow into a Software Architecture.

Performing User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT-V

Software Quality Assurance: Basic Elements, Tasks, Goals and Metrics, Formal Approaches, Statistical Software Quality Assurance, Software Reliability, ISO 9000 Quality Standards, SQA Plan.

Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for O-O Software, Validation Testing, System Testing, The Art of Debugging.

Suggested Readings:

1. "Software Enigneering: A Practitioner's Approach",Roger S.Pressman, McGraw Hill, 7th Edition, 2009.
2. "Software Engineering Fundamentals", Ali Behforooz and Frederick J.Hudson, Oxford University Press, 1996.
3. "An Integrated Approach to Software Engineering", Pankaj Jalote, Narosa Publishing House,3rd Edition, 2008.

Course code	Course Title						Core/Elective
U23EE508	NON-CONVENTIONAL ENERGY SYSTEMS						OEC-1
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
BEE	L	T	D	P			
Engineering Chemistry	3	-	-	-	40	60	3

Course Objectives

The objectives of this course are:

1. To understand the concepts and Importance of renewable energy sources such as solar energy and Solar radiation
2. To understand the concept of Solar energy Storage and applications
3. To understand the wind energy performance characteristics
4. To understand the concept of Bio-mass and Geothermal Energy applications
5. To understand the concept of energy extraction from OTEC

Course Outcomes

At the end of the course, the student will be able to

1. Acquire the knowledge of various components, principle of operation and present scenario of different conventional and non-conventional sources.
2. Understand the solar energy operation and its characteristics.
3. Educate the wind energy operation and its types.
4. Thestudentwillbeabletocopeupwithupcomingtechnologiesintheenergystoragesystems.
5. Illustrate the concepts of Direct Energy Conversion systems & their applications.

UNIT-I

Principles of Solar Radiation: Role and potential of new and renewable source, Environmental impact of solar power, physics of the sun, extra-terrestrial and terrestrial solar radiation, types & instruments for measuring solar radiations.

UNIT-II

Solar Energy Storage and Applications: Different methods, Sensible, Latent heat and Stratified Storage, Solar Ponds.

Solar applications: solar heating/cooling techniques, solar distillation and drying, solar photovoltaic energy conversion.

UNIT-III

Wind Energy: Sources and potentials, Horizontal and Vertical axis windmills, Performance characteristics

UNIT-IV

Bio-Mass: Principles of Bio-Conversion, Anaerobic /aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of biogas, utilization for cooking.

Geothermal Energy: Resources, types of wells, methods of harnessing the energy.

UNIT-V

Ocean Energy: OTEC, Principles, utilization, setting of OTEC plants, thermodynamic cycles. Tidal and Wave energy: Potential and conversion techniques, mini-hydel power plants.

Suggested Reading:

1. Renewable Energy Resources / Tiwari and Ghosal / Narosa
2. Non- conventional Energy Sources / G.D. Rai/ Khanna Publishers
3. Biological Energy Resources/ Malcolm Fleischer & Chris Lawis/ E&FN Spon

Course code	Course title						Core/Elective
U23EE509	ENERGY CONSERVATION AND MANAGEMENT						OEC-1
Pre-requisites	Contact Hours Per Week				CIE	SEE	Credits
Basic of Electrical Engineering	L	T	D	P			
	3	-	-	-	40	60	3

Course Objectives

The objectives of this course are:

1. Familiarize present energy scenario, and energy auditing methods.
2. Explain components of electrical systems, lighting systems and improvements in performance.
3. Demonstrate different thermal systems, efficiency analysis, and energy conservation methods.
4. Train on energy conservation in major utilities.
5. Instruct principles of energy management and energy pricing.

Course Outcomes

At the end of the course, the student will be able to

1. Explain energy utilization and energy auditing methods.
2. Analyze electrical systems performance of electric motors and lighting systems.
3. Examine energy conservation methods in thermal systems.
4. Estimate efficiency of major utilities such as fans, pumps, compressed air systems, HVAC and D.G. Sets.
5. Elaborate principles of energy management, programs, energy demand and energy pricing.

UNIT-I

Introduction: Energy, Power, Past & Present Scenario of World, National Energy Consumption Data, Environmental Aspects Associated with Energy Utilization, Energy Auditing: Need, Types, Methodology and Barriers, Role of Energy Managers, Instruments for Energy Auditing.

UNIT-II

Electrical Systems: Components of EB Billing, HT and LT Supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors, Motor efficiency computation, Energy efficient motors, Illumination, Lux, Lumens, Types of lighting, Efficacy, LED Lighting and Scope of Economy in Illumination.

UNIT-III

Thermal Systems: Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters, Efficiency Computation and Encon Measures. Steam, Distribution & Usage, Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories.

NIT-IV

Energy Conservation in Major Utilities: Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems, Cooling Towers, D.G. Sets.

UNIT-V

Energy Management: Principles of Energy Management, Energy Pricing.

Suggested Reading:

1. Energy Manager Training Manual (4 Volumes) Available At www.energymanagertraining.com, A Website Administered By Bureau Of Energy Efficiency (BEE), A Statutory Body Under Ministry Of Power, Government Of India, 2004.
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online).
3. Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation” Hemisphere

Course Code	Course Title						Core / Elective
U23ME509	BASICS OF MECHANICAL ENGINEERING						OEC-1
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Learn the fundamental concepts of energy, its sources and conversion
2. Comprehend the basic concepts of thermodynamics
3. Understand the concepts of boilers, turbines, pumps, internal combustion engines and refrigeration
4. Distinguish different metal joining techniques.
5. Enumerate the knowledge of working with conventional machine tools, their specifications.

Course Outcomes:

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

1. Identify different sources of energy and their conversion process.
2. Explain the working principle of steam boiler, hydraulic turbines, pumps, IC engines.
3. Recognize the use of internal combustion engine.
4. Recognize various metal joining processes and power transmission elements
5. Understand the properties of common engineering materials and their applications in engineering industry.

UNIT-I

Sources of Energy: Introduction and application of energy sources like fossil fuels, hydel, solar, wind, nuclear fuels and bio-fuels; environmental issues like global warming and ozone depletion. **Basic concepts of Thermodynamics:** Introduction, states, concept of work, heat, temperature; Zeroth, 1st, 2nd and 3rd laws of thermodynamics. Concept of internal energy, enthalpy and entropy (simple numericals).

UNIT-II

Steam: Formation of steam and thermodynamic properties of steam (simple numericals).

Boilers: Introduction to boilers, classification, Lancashire boiler, Babcock and Wilcox boiler. Introduction to boiler mountings and accessories (no sketches).

Turbines: Hydraulic Turbines – Classification and specification, Principles and operation of Pelton wheel turbine, Francis turbine and Kaplan turbine (elementary treatment only).

Hydraulic Pumps: Introduction, classification and specification of pumps, reciprocating pump and centrifugal pump, concept of cavitation and priming.

UNIT-III

Internal Combustion Engines Classification, I.C. Engines parts, 2 and 4 stroke petrol and 4-stroke diesel engines. P-V diagrams of Otto and Diesel cycles. Simple problems on indicated power, brake power, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency and specific fuel consumption.

UNIT-IV

Properties, Composition and Industrial Applications of engineering materials Metals – Ferrous: cast iron, tool steels and stainless steels and nonferrous: aluminum, brass, bronze. Polymers - Thermoplastics and thermosetting polymers. Ceramics - Glass, optical fiber glass, cermets. Composites - Fiber reinforced composites, Metal Matrix Composites Smart materials – Piezoelectric materials, shape memory alloys, semiconductors and insulators.

Joining Processes: Soldering, Brazing and Welding Definitions. Classification and methods of soldering, brazing and welding. Brief description of arc welding, oxy-acetylene welding, TIG welding, and MIG welding

UNIT-V

Belt drives: Open & crossed belt drives, Definitions -slip, creep, velocity ratio, derivations for length of belt in open and crossed belt drive, ratio of tension in flat belt drives, advantages and disadvantages of V belts and timing belts, simple numerical problems.
Gear drives: Types–spur, helical, bevel, worm and rack and pinion. Velocity ratio, advantages and disadvantages over belt drives, simple numerical problems on velocity ratio.

Suggested Readings:

1. "Elements of Mechanical Engineering", R.K. Rajput, Firewall Media, 2005
2. "Elements of Mechanical Engineering", Dr. A. S. Ravindra, Best Publications, 7th edition, 2009.
3. "Elements of Mechanical Engineering", K. R. Gopalakrishna, Subhas Publications, Bangalore, 2008.
4. "Elements of Mechanical Engineering", Vol.-1 & 2, Hajra Choudhury, Media Promoters, New Delhi, 2001.

Course Code	Course Title						Core / Elective
U23ME510	MODERN MANUFACTURING PROCESS						OEC-1
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
--	3	-	-	-	40	60	3

Course Objectives:

The objective of the course is to:

1. Know the importance of classification of various Non-Traditional machining processes and their applicability to various metals, non - metals & alloys.
2. Teach the mechanics and thermal issues associated with chip formation
3. Teach the effects of tool geometry on machining force components and surface finish
4. Teach the machining surface finish and material removal rate

Course Outcomes:

After completing the course, the student will be able to:

1. Understand the basic techniques of modern manufacturing processes.
2. Analyze and decide the process parameters to be adopted and applicability of various materials that are suitable for mechanical energy and spark energy-based machining processes
3. Understand the process parameters to be adopted and applicability of various materials that are suitable for chemical and electrical energy-based processes.
4. Analyze and decide the process parameters to be adopted and applicability of various materials that are suitable for chemical and electro-chemical energy-based machining processes
5. Analyze and decide the process parameters to be adopted and applicability of various materials that are suitable for thermal based machining processes.

Unit-I

Introduction: Need for non-traditional machining methods- Classification of modern machining processes – considerations in process selection, Materials, Applications, Ultrasonic machining – Elements of the process, mechanics of metal removal process, parameters, economic considerations, applications and limitations, recent development.

Unit-II

Mechanical Energy Based Processes: Abrasive Jet Machining – Water Jet Machining– Abrasive Water Jet Machining- Ultrasonic Machining (AJM, WJM, AWJM, USM).Working Principles – equipment used – Process parameters – MRR – Applications.

Unit-III

Electrical Energy Based Processes: Electric Discharge Machining (EDM) – workingPrinciples-equipments - Process Parameters- MRR- electrodes Used – Power Circuits –Dielectric – Flushing – Applications, Wire Cut EDM- Applications.

Unit-IV

Chemical and Electro-Chemical Energy Based Processes: Chemical Machining andElectro-Chemical machining (CHM and ECM)-Etchants- maskants -techniques of applying maskants- Process Parameters – MRR-Applications-Principles of ECM equipments- MRR-Processes Parameters.

Unit-V

Thermal Energy Based Processes: Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (EBM), Principles-Equipment-Process Parameters - Applications.

Advanced Machining Processes: Magnetic abrasive finishing, Abrasive flow finishing,Electro stream drilling, shaped tube electrolyte machining.

Suggested Readings:

1. "Advanced Machining Processes", Vijay K. Jain, Allied Publishers.
2. "Modern Machining Processes", P. C. Pandey, H. S. Shan, Tata McGraw- Hill Education.
3. "Nontraditional Manufacturing Processes", Benedict. G. F, Marcel Dekker.
4. "Advanced Methods of Machining", McGeough, Chapman and Hall, London.
5. "Unconventional Machining Processes", P. K. Mishra, Narosa.

Course Code	Course Title						Core/Elective
U23CE510	DISASTER PREPAREDNESS AND MANAGEMENT						OEC-1
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Environmental Engineering	3	-	-	-	40	60	3

Course Objectives:

1. Learn about the basic principles of disaster management and the types of disasters
2. Understand the disaster management cycle and framework.
3. Know about the disaster management systems in India and the applications of the latest technologies in disaster management
4. Understand about the different types of disasters.
5. Know about the past disasters occurred across the globe.

Course Outcomes:

After completing this course, the student will be able to

1. Apply the concepts of disaster management to evaluate a disaster situation.
2. Classify the various categories of disasters and their specific characteristics.
3. Classify the areas under disaster management.
4. Select appropriate pre-disaster, during disaster and post-disaster measures and framework.
5. Apply the geo informatics technology in disaster situation.

UNIT-I

Introduction: Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk and Capacity– Disaster and Development, and disaster management.

UNIT-II

Disasters: Geological Disasters (earthquakes, landslides ,tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters –Climate Change and Urban Disasters.

UNIT-III

Disaster Management Cycle and Framework: Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness. During Disaster–Evacuation–Disaster Communication – Search and Rescue – Emergency Operation Centre – incident Command System – Relief and Rehabilitation. Post-disaster–Damage and Needs Assessment, Restoration of Critical Infrastructure–Early Recovery–Reconstruction and Redevelopment; IDNDR.

UNIT-IV

Disaster Management in India: Disaster Profile of India – Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter Governmental Agencies.

UNIT-V

Applications of Science and Technology for Disaster Management: Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non-Structural Mitigation of Disasters S&T Institutions for Disaster Management in India.

Suggested Reading

1. Disaster Management Global Challenges and Local Solutions" Rajib, Sand Krishna Murthy, R.R, CRC Press, 2009.
2. Earth and Atmospheric Disasters Management, Natural and Manmade. Navele, P & Raja, C.K, B. S. Publications, 2009
3. Disaster Science and Management, Bhattacharya, Tata Mc GrawhillCompany,2017
4. Manual on natural disaster management in India, MC Gupta, NIDM, New Delhi
5. An overview on natural & man-made disasters and their reduction, RK Bhandani, CSIR, New Delhi
6. Disaster Management Act 2005, Published by Govt. of India.

Course Code	Course Title						Core/Elective
U23CE511	HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOR						OEC-1
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	40	60	3

Course Objectives:

The objectives of this course are:

1. Understand management process and functions
2. Comprehend decision making and negotiations
3. Learn psychological contract
4. Study the models of organization behavior
5. Managing stress and counseling

Course Outcomes:

After completing this course, the student will be able to

1. Explain various facets of management
2. Elaborate on ways of making decision
3. Elucidate different motivation content theories
4. Describe approaches to leadership
5. Suggest methods for stress management and counseling

UNIT – I

Management Process and Functions, Scientific and Modern Management, 3D Model of Managerial Behavior - MBO - MBWA - Line and Staff - The Peter's Principle - Parkinson's Law - Approaches to Organization Structure-Management - Classical, Human Relations, Systems and Contingency Approaches, Hawthorne's Experiments - Human Engineering.

UNIT – II

Decision Making and Negotiations: Approaches to Decision making - Rational, Behavioral, Practical, and Personal Approaches - Open and Closed Models of Decision Making, Types and steps in planning, Authority, Responsibility, Centralization, Decentralization and Recentralization, Bureaucracy

UNIT – III

Psychological contract - Personality Traits, Big 5 personality traits, MBTI inventory, the Process of Perception - Perceptual distortions and errors, Kelly's personal construct Theory, Motivation Content Theories: Maslow, Alderfer, Herzberg, McCleland. Process Theories: Vroom, Potter and Lawler, Equity Theory - Goal Theory - Attribution Theory.

UNIT – IV

Models of Organization Behavior - Autocratic, Custodial, Supportive, Collegial and System Models, Transactional Analysis, Johari Window. Group Dynamics: Typology of Groups - Conflicts in groups - The nature, of conflict - Reactions to conflict - A model of conflict. Trait and BehavioralApproaches to Leadership, Managerial Grid, Path-Goal Theory, Vroom's Decision Tree Approach to Leadership - Hersey and Blanchard Model

UNIT – V

Organization Design, Organization culture and organization climate, Stress Management and Counseling, Management of change and organization development. Communication - Emerging aspects of OB.

Suggested Reading

1. Essentials of Management, Harold Koontz and Heinz Weihrich, 9th Edition, McGraw Hill Education, 2015
2. Management and Organizational Behavior, Curtis W. Cook and Phillip L. Hunsaker, 3 rd Edition, McGraw-Hill,2010

Course Code	Course Title						Core/Elective
U23EC507	PRINCIPLES OF COMMUNICATION THEORY						Open Elective-I
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Analog and Digital Communication	3	-	-	-	40	60	3

Course Objectives

The objectives of this course are:

1. Provide an introduction to fundamental concepts in the understanding of communications systems.
2. Provide an introduction to fundamental concepts in the understanding analog and digital communications.
3. Provide an introduction to network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
4. Provide an introduction to fundamental concepts in the understanding telephone communication systems and optical communication systems.
5. Provide an introduction to the evolution of wireless systems and current wireless technologies.

Course Outcomes

1. Students will be able to understand the concepts related to signal transmission and related communication parameters.
2. Students will be able to learn various modulation and demodulation techniques in analog and digital communication systems.
3. Students will be able to understand the OS Inter work model and the working of data transmission
4. Students will be able to understand the evolution of communication technologies by learning basic concepts of traditional telephony systems and fundamental concepts related to optical communication systems.
5. Students will be able to understand the fundamental concepts of various current wireless technologies.

UNIT–I

Introduction to communication systems: Electromagnetic Frequency Spectrum, Elements of Electronic Communications System, Types of Communication Channels. Signal Transmission Concepts: Baseband transmission and Broadband transmission, Communication Parameters: Transmitted power, Channel bandwidth and Noise, Need for Modulation. Signal Radiation and Propagation: Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT–II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, /Digital modulation schemes – ASK, FSK ,PSK QPSK, Digital demodulation.

UNIT–III

Data Communication and Networking: Topologies, Synchronous and asynchronous data transfer, Modes of Data Communication, OSI Model, Data Link Layer–Media Access control and Logic link control, Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer–TCP,UDP.

UNIT–IV

Telecommunication Systems: Standard Telephone set, Basic Telephone call procedure, Public Telephone Network, Instruments, local loops, trunk circuits and various telephone Exchanges

Optical Communications: Block diagram Optical Fiber Communication Systems, Optical Fiber – Classification and Configurations, Optical Fiber versus Metallic cable facilities, Wave length Division Multiplexing.

UNIT–V

Wireless Communications: AMPS overview, GSM architecture and channels, CDMA IS-95 forward and reverse channels. Current Wireless Technologies: WLL, Wireless LAN, Bluetooth, PAN and ZigBee, RFID communication, Comparison between 1G,2G,2.5G.3G.4G, 5G. Cellular telephone, Cell Splitting, Sectoring,

Segmentation, Roaming and Handoffs. Satellite Orbits, Satellite Classification, Spacing and frequency Allocation, Satellite systems link models

Suggested Readings:

1. "Electronic Communication Systems", Wayne Tomasi,5e, Pearson,2013.
2. "Data Communications and Networking", Behrouz A. Forouzan, 5e TMH,2012.
3. "Electronic Communications systems", Kennady, Davis, 4e, McGraw Hill,1999.

Course Code	Course Title						Core/Elective
U23EC508	BASIC ELECTRONICS						OEC-1
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Electronic Devices	3	-	-	-	40	60	3

Course Objectives

1. Study and Analyze the behavior of Semiconductor diodes in Forward and Reverse bias.
2. Develop Half wave and Full wave rectifiers with L, C Filters.
3. Explain V-I characteristics of Bipolar Junction Transistor in CB, CE & CC configurations.
4. Explore V-I characteristics of FETs, MOSFETs and study IC fabrication techniques
5. Study the operation of special purpose devices

Course Outcomes

1. Interpret the characteristics and apply diode models to analyse various applications of diodes.
2. Identify the merits and demerits of various filters, formulate and design rectifier circuits with filters Calculate ripple factor, efficiency and percentage regulation of rectifier circuits.
3. Discriminate the BJT configurations to recognize appropriate transistor configuration for any given application and design the biasing circuits with good stability.
4. Distinguish the working principles of BJT and FET also between FET & MOSFET.
5. To acquire knowledge on special purpose devices.

UNIT-I

Basics of Semiconductors: Energy bands in intrinsic and extrinsic Silicon. Carrier transport: diffusion current, drift current, mobility and resistivity; Hall Effect

Junction Diode: PN Junction formation, Characteristics, biasing–band diagram and current flow, Diode current equation, Break down in diodes, Diode as a circuit element.

UNIT-II

PN Diode Applications: Half wave, Full wave and Bridge rectifiers–their operation performance characteristics and analysis Filters (L, C filters) used in power supplies and their ripple factor calculations, design of Rectifiers with and without Filters.

UNIT-III

Bipolar Junction Transistor: Transistor Junctionformation(collector-base,base-emitterJunctions),Transistor biasing –band diagram for NPN and PNP transistors, current components and current flowing BJT Ebers moll model, Modes of transistor operation, BJT V-I characteristics in CB, CE, CC configurations

UNIT-IV

Junction Field Effect Transistor (FET): Construction, Principle of Operation, Pinch-Off Voltage, Comparison of BJT and FET, FET as Voltage Variable Resistor.

UNIT-V

Special Purpose Devices: Zener Diode, Voltage Regulator, Silicon Cathode Rectifier, TRIAC(triode for alternating current), DIAC(Diode for alternating current), Tunnel Diode, Unijunction Transistor(UJT),Varactor Diode, Light Emitting Diode, LASERS, Photo Diode, Photo Detector

Suggested Reading:

1. "Fundamentals of Electronic Devices and Circuits" David Bell, 2ndEdition,McGrawHill Publication, 2009.
2. "Electronic Devices and Circuits " S. Salivahanan ,N Suresh Kumar 4thEdition McGraw Hill Publication,2017
3. "Electronic Devices and Circuits", Millman and Halkias, 2nd Edition, McGraw Hill Publication, 2007.
4. "Electronic Devices and Circuit Theory", Robert L. Boylestad,10th Edition, PHI, 2009.

Course Code	Course Title						Core/Elective
U23MB501	**MANAGERIAL COMMUNICATION**						**OEC-1**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
	3	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

This course enable students to:

1. Understand the various approaches / aspects of business communication**.**

Course Outcomes:

After completing this course, the student will be able to:

1. The importance of Communication in Business
2. To develop writing skills and presentation
3. writing business proposals and letters
4. Application of business communication in the self-development process.
5. Infuse the relational management with various stakeholders

Unit – I:

The role of and process of communication. Barriers to communication surmount barriers to communication, Types of communication; Listening process–Elements of good listening– improving listening competence. Importance of feedback – Principles of feedback.

Unit – II:

Characteristics of non-verbal communication–Types and functions of non- verbal communication–Interpreting non-verbal communication; Negotiations- Approaches to negotiations–Preparing for and conducting negotiations

Unit – III:

Making Presentations–Choosing a method of speaking–Analyzing the audience–Nonverbal dimensions of presentations–Speeches for commemorative occasions–Effective presentation strategies. Persuasive speaking.

Unit – IV:

Report writing–Types of reports–Structure of reports–Individual and committee reports– Essentials of good report writing .Business

letters–Drafting letters relating to enquiries and replies; orders and replies; complaints and claims. Effective business correspondence .drafting a resume

Unit – V:

Media relations–Building better relations with media. Investor relations–Framework for managing investor relations. Managing government relations–ways and means of managing governing power. Crisis communication–Do‟s and dont‟s in the wake of a crisis.

Suggested Books:

1. Penrose, Rasberry and Myers, “Business Communication for Managers”, Cengage Learning.
2. Kathleen Fearn-Banks, “Crisis Communications, A Casebook Approach”, Routledg Mary Munter, “Guie to Managerial Communication” 6th Ed Pearson Education.
3. Lesikar, R.V. and M.E. Flatley, “Basic Business Communication”, 2008 11th Ed. New York, McGraw
4. Disanza, “Business and Professional communication”, Pearson Education.
5. CSG Krishnama charyalu and L.Ramakrishnan, “Business Communications”, 2009, Himalaya Publishing House.
6. Paul A Argenti, “Strategic Corporate Communications”, Tata McGraw Hill.
7. Krizan, Merrier, Logan and Williams, “Effective Business Communication”, 2008 CengageLearning.
8. Paul R.Timm, “Straight Talk: Written communication for career success”,Routledge Publication.
9. David Irwin, “Effective Business Communications”, 2009, Viva Books. Kelly Quintanilla and Shawn T Wahl, “Business and Professional communication”, Sage Publications.

Course Code	Course Title						Core/Elective
U23CM5L1 U23CM6L2	**MACHINE LEARNING LAB**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Python Programming	**-**	**-**	**3**	**3**	**25**	**50**	**1.5**

Course Objectives:

This course enable students to:

1. To introduce students to the basic concepts of Data Science and techniques of Machine Learning.
2. To develop skills of using recent machine learning software for solving practical problems.
3. To gain experience of doing independent study and research.
4. Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own
5. Be capable of performing experiments in Machine Learning using real-world data.

Course Outcomes:

On completion of this course, the students are able to:

1. The student must be able to design and implement machine learning solutions to classification, regression problems.
2. Understand complexity of Machine Learning algorithms and their limitations
3. Able to evaluate and interpret the results of the algorithms.
4. Implement Decision trees and various algorithms
5. Implement and Analyze various random forest techniques.

1. Implement a program to demonstrate the following
   a) Operation of data types in Python.
   b) Different Arithmetic Operations on numbers in Python.
   c) Create, concatenate and print a string and access substring from a given string.
   d) Append, and remove lists in python.
   e) Demonstrate working with tuples in python.
   f) Demonstrate working with dictionaries in python.

2. Using python write a NumPy program to compute the
   a) Expected Value
   b) Mean
   c) Standard deviation
   d) Variance
   e) Covariance
   f) Covariance Matrix of two given arrays.

3. For a given set of training data examples stored in a .CSV file, demonstrate Data Preprocessing in Machine learning with the following steps
   a) Getting the dataset.
   b) Importing libraries.
   c) Importing datasets.
   d) Finding Missing Data.
   e) Encoding Categorical Data.
   f) Splitting dataset into training and test set.
   g) Feature scaling.

4. Build a linear regression model using python for a particular data set by
   a) Splitting Training data and Test data.

b) Evaluate the model (intercept and slope).
c) Visualize the training set and testing set
d) predicting the test set result
e) compare actual output values with predicted values

5. The dataset contains information of users from a company's database. It contains information about UserID, Gender, Age, EstimatedSalary, and Purchased. Use this dataset for predicting that a user will purchase the company's newly launched product or not by Logistic Regression model.

User ID	Gender	Age	EstimatedSalary	Purchased
15624510	Male	19	19000	0
15810944	Male	35	20000	0
15668575	Female	26	43000	0
15603246	Female	27	57000	0
15804002	Male	19	76000	0
15728773	Male	27	58000	0
15598044	Female	27	84000	0
15694829	Female	32	150000	1
15600575	Male	25	33000	0
15727311	Female	35	65000	0
15570769	Female	26	80000	0
15606274	Female	26	52000	0
15746139	Male	20	86000	0
15704987	Male	32	18000	0
15628972	Male	18	82000	0
15697686	Male	29	80000	0
15733883	Male	47	25000	1
15617482	Male	45	26000	1
15704583	Male	46	28000	1

6. Implement a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

7. Implement k-nearest neighbor's classification to classify the iris data set using python.

8. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids)

VAR1	**VAR2**	**CLASS**
1.713	1.586	0
0.180	1.786	1
0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1
0.773	0.186	1

9. Evaluate the metrics for all types of machine learning algorithms using sample data.

10. Implement an algorithm to demonstrate the significance of SVM.

U23MA5L1**Suggested Readings:**

1. The Field Guide to Data Science ,Booz, Allen, Hamilton,Manning Publications 2nd Edition,2018.
2. Hands-On Machine Learning with Scikit-Learn and TensorFlow,Aurélien Géron, O'Reilly Media, 1st Edition,2017.
3. Machine Learning in Action, Peter Harrington, Manning Publications.2012.

Course Code	Course Title						Core/Elective
U23CS5L2	**SCRIPTING LANGUAGES LAB**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Programming for Problem Solving	**-**	**-**	**-**	**2**	**50**	**-**	**1**

Course Objectives:

This course enable students to:

To develop an ability to design and implement static and dynamic website

2. Create conforming web pages
3. Use JavaScript for dynamic effects
4. Understand, analyze and create XML documents and XML Schema
5. Use appropriate client-side or Server-side applications.

Course Outcomes

After completing this course, the student will be able to:

Understand, analyze and apply the role of languages like HTML, CSS, XML, JavaScript, PHP, SERVLETS, JSP and protocols in the workings of the web and web applications

2. Design and implement dynamic websites with good aesthetic sense of designing
3. Create web pages using HTML and Cascading Styles sheets
4. Analyze a web page and identify its elements and attributes.
5. Develop JSP applications implementing Session management and Data base Connectivity.

List of Experiments

1)Design the following static web pages required for an online book store web site.

a) HOME PAGE: The static home page must contain three frames.
b) LOGIN PAGE
c) CATOLOGUE PAGE: The catalogue page should contain the details of all the books available in the web site in a table.
d) REGISTRATION PAGE.

2) Write JavaScript to validate the following fields of the Registration page.

1. First Name (Name should contains alphabets and the length should not be less than 6 characters).
2. Password (Password should not be less than 6 characters length).
3. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com)
4. Mobile Number (Phone number should contain 10 digits only).
5. Last Name and Address (should not be Empty).

3) Develop and demonstrate the usage of inline, internal and external style sheet using CSS

4) Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems:

a) Input: Click on Display Date button using onclick( ) function Output: Display date in the textbox
b) Input: A number n obtained using prompt Output: Factorial of n number using alert
c) Input: A number n obtained using prompt Output: A multiplication table of numbers from 1 to 10 of n using alert
d) Input: A number n obtained using prompt and add another number using confirm Output: Sum of the entire n numbers using alert.

5) Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital

(color, bold and font size)

6) Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.

7) Develop and demonstrate PHP Script for the following problems:
   a) Write a PHP Script to find out the Sum of the Individual Digits.
   b) Write a PHP Script to check whether the given number is Palindrome or not.

8) Create an XML document that contains 10 users information. Write a Java Program, which takes User Id as input and returns the user details by taking the user information from XML document using DOM parser or SAX parser.

9) Implement the following web applications using (a) PHP (b) JSP
   a) A web application that takes a name as input and on submit it shows a hello page where name is taken from the request. It shows the start time at the right top corner of the page and provides a logout button. On clicking this button, it should show a logout page with Thank You message with the duration of usage (hint: Use session to store name and time).
   b) Write a PHP Program to display current Date, Time and Day.

10) Implement the following web applications using (a) PHP (b) JSP
   a) A web application that takes name and age from an HTML page. If the age is less than 18, it should send a page with "Hello , you are not authorized to visit the site" message, where should be replaced with the entered name. Otherwise it should send "Welcome to this site" message.
   b) A web application that lists all cookies stored in the browser on clicking "List Cookies" button. Add cookies if necessary.

11) Implement the web applications with Database using (a) PHP, JSP

12) Write a program to design a simple calculator using (a) JavaScript (b) PHP (c) JSP.

Suggested Readings:

1. "The Complete Reference PHP, Tata McGraw-Hill", StevenHolzner,1st Edition,2007
2. "Web Technologies, Oxford University Press", Uttam KRoy, 1stEdition,2010.
3."JavaScript: The Definitive Guide", David Flanagan O'Reilly, 6th Edition

Course Code	Course Title						Core/Elective
U23CM5P1	**INTERNSHIP**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**50**	-	**1**

Course Objectives:

This course enable students to:

1. Produce an accurate record of work performed during the Internship/Co-op
2. Apply engineering knowledge to a problem in industry
3. Produce a technical report
4. Discuss work in a team environment, if relevant to the project
5. Conduct herself/himself responsibly, safely, and ethically in a professional environment

Course Outcomes:

After completing the course, the student will be able to:

1. Design/develop a small and simple product in hardware or software.
2. Complete the task or realize a pre specified target, with limited scope, rather than taking up a complex task and leave it.
3. Learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to pre specified criteria.
4. Implement the selected solution and document the same.

Guidelines:

Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch of three students will be attached to a person from the Government or Private Organizations /Computer Industry/Software Companies/R&D Organization for a period of 4 weeks. This will be during the summer vacation following the completion of the III-year Course. One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry co-ordinate (person from industry). The course schedule will depend on the specific internship/training experience. The typical time per topic will vary depending on the internship

1. Overview of company/project
2. Safety training
3. Discussions with project teams
4. Background research, review of documents, white papers, and scientific papers
5. Planning, designing, and reviewing the planned work
6. Executing the plans
7. Documenting progress, experiments, and other technical documentation
8. Further team discussions to discuss results
9. Final report writing and presentation

After the completion of the project, each student will be required to:

1. Submit a brief technical report on the project executed and
2. Present the work through a seminar talk (to be organized by the Department)

Note: Students have to undergo summer internship of 4 weeks at the end of semester IV and credits will be awarded after evaluation in V semester.

Course Code	Course Title						Core/Elective
U23MA5L1	**APTITUDE AND REASONING SKILLS LAB**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**2**	**2**	**25**	**50**	**1**

Course Objectives

This course enable students to:

1. Acquire the concepts of mathematical aptitude and reasoning.
2. Develop the innovative and creative thinking through basic mathematical concepts.
3. Improve analytical and problems solving skills.
4. Enhance logical thinking and mathematical ability.
5. Empower with the basic tools of mathematical aptitude.

Course Outcomes

After completing this course, the student will be able to:

1. Build proficiency in quantitative reasoning
2. Improve critical thinking skills
3. Enhance analytical skills
4. Demonstrate quantitative aptitude concepts
5. Adapt principles of quantitative aptitude to achieve qualitative results.

Guidelines

1) **Basic concepts**: combined mean, average principles, wrong values taken, number added or deleted, average speed.

2) **Percentages** -Basic Concepts, conversions, finding percentages from given numbers, quantity increases or decreases by given percentage, population increase by given percentage, comparisons, consumption when a commodity price increase or decrease and applications.

3) **Data Interpretation** - Introduction to Data Interpretation, quantitative and qualitative data, Tabular Data, Line Graphs, Bar Chart, Pie Charts, X-Y Charts.

4) Number Series, Letter Series, Series completion and correction, Coding and Decoding. Word analogy-Applied analogy, Classifications, verbal classification.

5) **Reasoning Logical Diagrams** - Simple diagrammatic relationship, Multi diagrammatic relationship, Venn-diagrams, Analytical reasoning.

Reasoning Ability - Blood Relations, Seating arrangements, Directions, Decision making. Number Systems: Basic Concepts,

6) **Number Systems**: Natural numbers, whole numbers, integers, fractions, Rational Numbers, Irrational Numbers, Real Numbers, Divisibility Rules, Logic Equations, Remainder theorem, Unit digit calculation.

Progressions & Inequalities: Basic Concepts, Types: arithmetic, geometric, harmonic progression and applications.

7) **Profit and Loss**: Basic Concepts, discounts, marked price and list price, dishonest shopkeeper with manipulated weights, successive discounts etc.

Interest (Simple and Compound): Basic Concepts, Yearly, Half-yearly, and quarterly calculations, multiples, differences between simple and compound interest.

8) **Ratio and Proportion**: Basic Concepts of ratio and proportion, continued or equal proportions, mean proportions, invest proportion, alternative proportion, division proportion, compound proportion, duplication of ratio, finding values, coins and currencies, etc.

9) **Speed, Time and Distance**: Basic Concepts, Single train problems, two train problems: some point same side, some point opposite sides, relative speed, different points meeting at common points, different points same side (different timings vs. same timings), ratios, number of stoppages, average speed, etc.

10) **Time and Work**: Basic Concepts, comparative work, mixed work, alternative work, middle leave and middle join, ratio efficiency.

11) **Permutations and combinations**: Basic Concepts, differences between permutations and combinations, alternative arrangement, fixed positions, items drawing from a single group, items drawing from a multiple group, total ways of arrangement with repetitions and without repetitions, handshakes or line joining between two points or number of matches, sides and diagonals, etc.

12) **Clocks and Calendars**: Basic Concepts, Angle between minute hand and hour hand, reflex angle, hours hand angle, time gap between minute hand and hour hand, relative time: coincide, opposite sides and right angle, mirror images, faulty clock (slow/fast), miscellaneous, calendar.

13) **Geometry and Mensuration**: Basic concepts, types of angles.

Plane figures: rectangles, squares, triangles, quadrilateral, areas, perimeters, etc.

Solid figures: cubes, cuboids, cylinders-area (total surface area and lateral surface area), volumes, perimeters.

Others: Parallelogram, Rhombus, Trapezium, Circle, Sector, Segment, Cone, Sphere, Hemisphere, etc.

Suggested Readings:

1. Aptitude and reasoning skills lab Manual, LIET, HYD.

LORDS INSTITUTE OF ENGINEERINGANDTECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF COMPUTER SCIENCE & ENIGINEERING ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
SCHEME OF INSTRUCTIONS & EXAMINATIONS [LR-23]
(W.e.f Academic Year 2024-25)

B.E.VI-Semester

S.No.	Course Code	Category	Course Title	Scheme of Instructions				Scheme of Examination			CREDITS
				L	T	P/D	Contact Hours/	Maximum Marks		Duration in Hours	
								CIE	SEE		
Theory Course											
1	U23CM601	PCC	Advanced Machine Learning	3	0	0	3	40	60	3	3
2	U23IT602	PCC	Design and Analysis of Algorithms	3	0	0	3	40	60	3	3
3	U23CD602	PCC	Computer Networks	3	0	0	3	40	60	3	3
4	-	PEC	Professional Elective–II	3	0	0	3	40	60	3	3
5	-	OEC	Open Elective-II	3	-	-	3	40	60	3	3
Practical/Laboratory Course											
6	U23CM6L1	PCC	Advanced Machine Learning Lab	-	-	3	3	25	50	3	1.5
7	U23CD6L2	PCC	Computer Networks Lab	-	-	3	3	25	50	3	1.5
8	U23IT6L2	PCC	Design and Analysis of Algorithms Lab	0	0	3	3	25	50	3	1.5
Project											
9	U23CM6P1	PROJ	Mini Project	-	-	4	4	50	50	3	2
Total				**15**	**1**	**13**	**28**	**325**	**500**	**27**	**21.5**

L:Lecture*(Hrs/Wk/Sem)* **T**:Tutorial*(Hrs/Wk/Sem)* **P**:Practical **D**:Drawing*(Hrs/Wk/Sem)*
CIE: Continuous Internal Evaluation **AM:**AI&ML **SEE**: Semester End Examination
PCC: Program core course **PEC:** Professional Elective Course **CM:** CSE-AIML
OEC: Open Elective Course **PROJ**: Project **IT:** Information Technology

Note:
1. Each contact hour is a Clock Hour.

2. The duration of the practical class is three hours, however it can be extended where ever necessary, to enable the student to complete the experiment.

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Professional Elective–II

U23CM603	Artificial Neural Networks
U23CM604	Introduction to Internet of Things
U23CM605	R- For Data Science
U23CM606	Compiler Design

OPEN ELECTIVE COURSES OFFERED(OE-2)

U23EE609	Electrical Installation and Safety
U23CS607	Java Programming
U23IT606	Operating Systems
U23ME609	Basics Of 3-D Printing
U23ME610	Optimization Methods for Engineers
U23CE607	Construction Materials
U23CE608	Engineering Geology
U23EC607	Principles of Data Communication and Network
U23EC608	Embedded Systems
U23MB602	Total Quality Management
U23MB603	Innovation Management
U23SH601	Indian Music System
U23SH602	Introduction to Art and Aesthetics
U23CM607	Fundamentals of Machine Learning

Course Code	Course Title						Core/Elective
U23CM601 ,U23AM702	**Advanced Machine Learning**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Machine Learning	**3**	**1**	**-**	**-**	**40**	**60**	**4**

Course Objectives

This course enable students :

1. To introduce advanced concepts and methods of Machine learning.
2. To develop an understanding of the role of machine learning in massive scale automation.
3. To design and implement various machine learning algorithms in the range of real world applications.
4. To develop reinforcement Learning through feedback network, function approximation.
5. To understand ensemble methods.

Course Outcomes

After completing this course, the student will be able

1. To introduce advanced concepts and methods of Machine learning.
2. To develop an understanding of the role of machine learning in massive scale automation.
3. To design and implement various machine learning algorithms in the range of real world applications.
4. To understand Reinforcement Learning through feedback network, function approximation.
5. To understand ensemble methods.

Unit I

Artificial neural network: Introduction to ANN, Perceptron, Cost function, Gradient checking, Multi layer perceptron and back propagation algorithm, convergence and local mininma, representational power of feed forward networks, hidden layer representation, generalization, overfitting and stopping criterion.

Unit II

Bayesian learning: Probability theory and Bayes rule, bayes theorem and concept learning, Naive Bayes learning algorithm, Bayesian belief Networks, the EM algorithm.

Unit III

Decision trees: Representing concepts as Decision trees, Recursive induction of Decision trees, Best splitting attribute: Entropy and Information gain, Searching for simple trees and Computational complexity, Overfitting, noisy data and pruning.

Unit IV

Genetic algorithms: genetic algorithms, extensions, hypothesis space search, genetic programming, models of evaluation and learning, parallelizing genetic programming, sequential covering algorithms, learning first order rules, inverting resolution.

Unit V

Reinforcement Learning: learning tasks, Q learning, non deterministic rewards and actions, Reinforcement Learning through feedback network, function approximation

Ensemble methods : Bagging, Boosting and learning with ensembles, Random forests.

Suggested Readings:

1.Machine learning ,Tom Mitchel, Mc Graw Hill,1997.
2. Introduction to Machine learning ,Jeeva Jose, Khanna book publishing,2020
3. Machine Learning ,Rajiv chopra ,Khanna book publishing,2021.
4. Machine Learning and Big Data Concepts, Algorithms, Tools and Applications. Uma N Dulhare, Khaleel Ahmad,Khairol AmaliBin Ahmad, ,Scrivener Publishing,Wiley,2020.
5. Introduction to Machine learning, Ethem Apaydin, the MIT press, 2010.

Course Code	Course Title						Core/Elective
U23IT602	**DESIGN AND ANALYSIS OF ALGORITHMS**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Data Structures	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

The objectives of this course are:

1. Acquire the knowledge of Algorithm and problem-solving technique, limitations of algorithms.
2. Understand different techniques like divide and conquer, transfer and conquer etc., to solve problems.
3. Understand different techniques like greedy method and dynamic programming
4. Understand the concepts of Np-Hard And Np-Complete.
5. Illustrating the methods of backtracking and branch bound techniques to solve the problems like N-queens problem, graph coloring

Course Outcomes:

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

1. Identify asymptotic notations and basic efficiency classes.
2. Solve problems using various techniques like divide-and-conquer and transfer-and-conquer.
3. Use different algorithms like TSP, Floyd's etc. to solve real world problems.
4. Introduce the P and NP classes.
5. Develop solutions for n - Queens problem, Subset – Sum Problem, Assignment problem, Knapsack problem etc.

UNIT - I

Characteristics of algorithm, Analysis of algorithm: Time and space, All six Asymptotic notations, Iterative and recursive algorithms analysis (Code snippets for common time complexities), back-substitution method, recursive tree method, master's theorem. Review of Analysis of Sorting algorithms (Bubble, quick, Heap, merge, insertion, selection sort), searching algorithms (Linear, binary).

UNIT - II

Divide and conquer: General method, finding Max-Min, Strassen's matrix multiplication, Karatsuba method, closest pair, convex Hull problem.

Transform and Conquer: Introduction, Balanced search trees.

Decrease and conquer: Introduction, Computing the Median

UNIT – III

Greedy method: General method, applications-Job sequencing with deadlines, knapsack problem, Single source shortest path problem, Huffman Coding for compression. Max flow problem, Connected components, Biconnected components. Introduction to Randomized algorithms. Examples of Monte Carlo and Las Vegas algorithms

Unit IV

Dynamic Programming: General method, applications- matrix chain multiplication, Optimal binary search tree, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, multi-stage graph, Warshall's , Transitive Closure, Floyd's Algorithm All pairs shortest algorithm, Reliability design.

UNIT – V

Branch and Bound: General method, applications - Traveling salesperson problem, 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution.

Backtracking: The general Method, 8-Queens Problem, Graph Coloring, and Hamiltonian Cycle

NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP-Hard and NP-Complete classes, Cook's theorem. Introduction to Approximate algorithms.

.Suggested Readings:

1."Introduction to The Design and Analysis of Algorithms", Anany Levitin (Chapters 1-5,7,9,11), Pearson Education, Delhi, 2nd Edition, 2007, ISBN: 9780321358288.
2."Fundamentals of Computer Algorithms", Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran: (Chapters 1,3-8,10-12), Universities Press, Hyderabad, 2nd Edition, 2007, ISBN: 10: 8173716129.

3."Introduction to Algorithms", Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: PHI, London, England, 3rd Edition, 2010, ISBN: 9780262033848.

4."Introduction to the Design and Analysis of Algorithms A Strategic Approach", R.C.T. Lee, S.S. Tseng, R.C. Chang and Y.T. Tsai: McGraw-Hill Higher Education, USA, International Edition, 2005, ISBN-13: 978-0071243469.

Course Code	Course Title						Core/Elective
U23CD602	**COMPUTER NETWORKS**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Operating Systems	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives

1. To introduce the fundamental various types of computer networks.
2. To demonstrate the TCP/IP and OSI models with merits and demerits.
3. To explore the IP Addressing Mechanisms
4. To Understand the World Wide Web concepts.
5. Classify the routine protocols and analyze how to assign the IP address for the given network.

Course Outcomes:

1. Explain & design the various reference models and networks.
2. Identify the different types of network devices and Multiple Access Protocols.
3. Use IP addressing Scheme and to interconnect various networks and Routing mechanism
4. Explain transport layer protocols: TCP, UDP.
1. Explain and use various application layer protocols: HTTP, DNS, and SMTP, FTP etc

UNIT – I

Data Communications: Components – Direction of Data flow – Networks, Components and Categories, Network devices, Types of Connections, Topologies, Protocols, OSI model, TCP/IP Protocol Suite, Wireless LAN**,** VPN

Physical layer: Transmission modes, Multiplexing, Transmission Media, Switching, Types of Switching

UNIT – II

Data link layer: Introduction, Framing, Error Detection and Correction – Parity, CRC, Hamming code, Flow and Error Control: Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols.

Medium Access Protocols: Random access, Controlled access, Channelization, LAN– Ethernet IEEE 802.3, IEEE 802.5, IEEE 802.11

UNIT – III

Network layer: Logical Addressing - IPv4, IPv6 protocol, Subnetting, Internetworking, Tunneling, Address mapping, Packet fragmentation, , Delivery, Forwarding, **Routing**-Static routing, Default routing, Dynamic routing, Hierarchical Routing

UNIT – IV

Transport Layer: Process to Process Delivery, UDP and TCP protocols, TCP Services, TCP Segment Format, connection establishment, The TCP connection release, Data Traffic, Congestion, TCP Congestion Control, Quality of Services, Integrated Services, Differentiated Services

UNIT – V

Application Layer: Application layer services**,** Domain name space, electronic mail, FTP, WWW, Uniform Resource Locator, HTTP, SNMP, TELNET, SSH, VOIP, Bluetooth Proxy Server

Suggested Readings

1. Data Communications and Networking, Behrouz A. Forouzan , Fourth Edition TMH, 2006.
2. Computer Networks, Andrew S Tanenbaum, 4th Edition. Pearson Education, PHI.
3. Data communications and Computer Networks, P.C .Gupta, PHI.
4. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education.

Course Code	Course Title						Core/Elective
U23CM603	**ARTIFICIAL NEURAL NETWORKS**						**PE-2**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Machine Learning, Artificial Intelligence	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

This course enable students to:

1. Understand the role of neural networks in engineering, artificial intelligence, and cognitive modeling.
2. Provide knowledge of types of neural networks.
3. Practical approach for using artificial neural networks in various technical, organizatorial and economic applications.
4. Prospects for use of artificial neural networks in products.
5. Understand the mathematical equations, and the role of the various parameters.

Course Outcomes:

After completing this course, the student will be able to

1. Understand the difference between biological neuron and artificial neuron.
2. Understand the application areas of neural networks
3. Understand building blocks of Neural Networks.
4. Develop neural network models.
5. Design and develop applications using neural networks.

UNIT-I

General characteristics of the human brain, Introduction to Biological Neural Networks, Nerve structure and synapse, Basic concepts of Neural Networks, Characteristics of Neural Networks, Terminologies, Applications of the artificial neural networks.

UNIT-II

Structure of a neural net (topology), Directed graphs, Models of Neuron, Neural Network Architectures, Artificial Neuron, Activation functions, Threshold function, Piecewise linear function, Sigmoidal function, Supervised learning, Unsupervised learning, Re-enforcement learning.

UNIT-III

Knowledge Representation, Artificial Intelligence, Learning rules, Error correction learning, Memory based learning, Hebbian learning, Competitive learning, Boltzmann learning, Single layer perceptron, Multilayer perceptron, Back propagation, Recurrent networks, Network Pruning.

UNIT-IV

Adaptive networks, Supervised Learning Neural Networks, Decision-based neural networks, Hierarchical neural networks, Probabilistic neural network, Radial basis function networks, Comparison of RBF Networks and Multilayer perceptron.

UNIT-V

Classification of linearly separable patterns, Boltzmann machine, Sigmoid Belief Networks, Helmholtz machine, Support vector machines, Self organization maps, Genetic Algorithms, Optimization, Prediction Systems, speech and decision-making.

Suggested Readings:

1."Neural Networks a comprehensive Foundation",S. Haykin, Prentice-Hall India,2nd Edition,1997.
2."Fundamentals of Neural Networks, Architecture, Algorithms, and Applications", Laurene Fausett, Prentice Hall,ist Edition, 1993.
3."The Handbook of Brain Theory and Neural Networks", Michael A Arbib, MIT Press, 2ndEdition, 2003.
4.Introduction to Artificial Neural Systems, Jacek M. Zurada, Jaico, Publ. House, 1994.

Course Code	Course Title						Core/Elective
U21CM802	**Internet of Things**						**PE-2**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

This course will enable students to

1. Impart necessary and practical knowledge of components of Internet of Things
2. Develop skills required to build real-life IOT based projects.
3. Explore IoT Communication Technologies and Protocols
4. Analyze IoT and M2M Architectures.
5. Evaluate and Utilize IoT Platforms and Ecosystems

Course Outcomes:

On completion of this course, the students are able to

1. Understand Internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules
3. Remotely monitor data and control devices
4. Develop real life IOT based projects.
5. Summarize the genesis and impact of IoT applications, architectures in real world.

UNIT – I

Introduction to IOT: Definition, Characteristics of IOT, Physical Design of IOT, Logical Design of IOT, IOT Levels and Deployment Templates, IOT Sensors and Actuators. IOT Applications: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle.

UNIT – II

Arduino Programming: Arduino and ESP8266 boards. Arduino IDE programming, working with sensors and actuators, libraries, digital interfaces. Interfacing with analog and digital devices, working with Bluetooth and Wi-Fi modules.

UNIT – III

IOT Enabling Technologies: RFID and NFC, Bluetooth Low Energy (BLE), Wi-Fi, 6LowPAN, ZigBee, Z-Wave, LoRa, Protocols- HTTP, WebSocket, MQTT, CoAP, XMPP, Node- RED

UNIT – IV

IOT & M2M: M2M, Differences between IOT and M2M, SDN and NFV for IOT IOT System Management: Need for IOT System management, SNMP, NETCONF, YANG, IOT system management with NETCONF-YANG.

UNIT – V

IOT Platforms: IBM Watson IOT, Bluemix, Eclipse IOT, AWS IOT, Microsoft Azure IOT Suite, Google Cloud IOT, Thing Worx, GE Predix, Xively.

Suggested Readings:

1. Vijay Madisetti, Arshdeep Bahga, Ïnternet of Things, "A Hands on Approach", University Press.
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", 1st Edition, 2007, CRC Prefer
3. Raj Kamal, "Internet of Things: Architecture and Design", 2nd Edition, 2022, McGraw Hill

Cuno Pfister, "Getting Started with the Internet ofThings", 2011, O Reilly Media

Course Code	Course Title						Core/Elective
U23CM605	**R- For Data Science**						**PE-2**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Mathematics-III	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

This course enable students to:

1. Introduce the Tool R to Execute the Data Science Programs.
2. Learn R built in functions.
3. Learn to plot graphs using R language..
4. Analyze a data set in R and present findings using the appropriate R packages.
5. Prepare or tidy data for in preparation for analysis.

Course Outcomes:

After completing this course, the student will be able to:

1. Identify and execute basic syntax and programs in R.
2. Perform the Matrix operations using R built in functions.
3. Apply non numeric values in vectors
4. Create the list and data frames.
5. Exploit the graph using ggplot2.

UNIT – I

Overview of R: History and Overview of R- Basic Features of R-Design of the R System- Installation of R-Console and Editor Panes- Comments- Installing and Loading R Packages- Help Files and Function Documentation Saving Work and Exiting R- Conventions- R for Basic Math- Arithmetic- Logarithms and Exponentials E-Notation- Assigning Objects- Vectors- Creating a Vector- Sequences, Repetition, Sorting, and Lengths- Subsetting and Element Extraction- Vector-Oriented Behaviour**.**

UNIT – II

MATRICES AND ARRAYS: Defining a Matrix – Defining a Matrix- Filling Direction- Row and Column Bindings- Matrix Dimensions Subsetting- Row, Column, and Diagonal Extractions- Omitting and Overwriting- Matrix Operations and Algebra- Matrix Transpose- Identity Matrix- Matrix Addition and Subtraction- Matrix Multiplication Matrix Inversion-Multidimensional Arrays- Subsets, Extractions, and Replacements

UNIT – III

NON-NUMERIC VALUES: Logical Values- Relational Operators- Characters- Creating a String-Concatenation- Escape Sequences Substrings and Matching- Factors- Identifying Categories- Defining and Ordering Levels- Combining and Cutting

UNIT – IV

LISTS AND DATA FRAMES: Lists of Objects-Component Access-Naming-Nesting-Data Frames-Adding Data Columns and Combining Data Frames-Logical Record Subsets-Some Special Values-Infinity-NaN-NA-NULL Attributes- Object-Class-Is-Dot Object-Checking Functions-As-Dot Coercion Functions.

UNIT – V

BASIC PLOTTING: Using plot with Coordinate Vectors-Graphical Parameters-Automatic Plot Types-Title and Axis Labels Color-Line and Point Appearances-Plotting Region Limits-Adding Points, Lines, and Text to an Existing Plot-ggplot2 Package-Quick Plot with qplot-Setting Appearance Constants with Geoms--READING AND WRITING FILES- R-Ready Data Sets- Contributed Data Sets- Reading in External Data Files- Writing Out Data Files and Plots- Ad Hoc Object Read/Write Operations.

Suggested Readings:

1. "THE BOOK OF R - A FIRST PROGRAMMING AND STATISTICS", Tilman M.Davies, Library of Congress Cataloging-in-Publication Data,2016.
2. "R Programming for Data Science", Roger D. PengLean, Publishing, 2016.
3. " R for Data Science",Hadley Wickham, Garrett Grolemund, OREILLY Publication,2017
4. "R Programming for Beginners", Steven Keller, CreateSpace Independent Publishing Platform, 2016.
5. "Learning R Programming", Kun Ren Packt Publishing,2016

Course Code	Course Title						Core/Elective
U23CM606	**COMPILER DESIGN**						**PE-2**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Automata Theory, Language & Computation	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

This course enable students to:

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis.
3. Design top-down and bottom-up parsers.
4. Identify synthesized and inherited attributes.
5. Develop syntax directed translation schemes.

Course Outcomes

After completing this course, the student will be able to

1. For a given grammar specification, develop the lexical analyzer.
2. For a given parser specification, design top-down and bottom-up parsers.
3. Develop syntax directed translation schemes.
4. Develop algorithms to generate code for target machine.
5. Develop algorithms to generate code for a target machine

UNIT - I

Introduction: The Structure of a Compiler, Phases of Compilation, The Translation Process, Major Data Structures in a Compiler, Bootstrapping and Porting.

Lexical Analysis (Scanner): The Role of the Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical Analyzer Generator Lex.

UNIT – II

SyntaxAnalysis

The Role of the Parser, Syntax Error Handling and Recovery, Top-Down Parsing: Backtracking , Recursive-descent Parsing, Predictive Parsers,LL(1)grammars, Bottom-Up Parsing: Simple LR Parsing, More Powerful LR Parsing, Using Ambiguous Grammars, Parser Generator YACC.

UNIT - III

Syntax-Directed Translation: Syntax-Directed Definitions, S-attributed and L- attributed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation.

Symbol Table: Structure, Operations, Implementation and Management.

UNIT - IV

Intermediate Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Back patching, Switch-statements, Intermediate Code for Procedures.

Run-time environment: Storage Organization, Stack Allocation of Space, Access to Non-local Data on the Stack, Parameter passing, Heap Management and Garbage Collection

UNIT – V

Code Generation: Issues in the Design of a Code Generator, The Target Language, addresses in the Target Code, Basic Blocks and Flow graphs, Optimization of Basic Blocks, Peephole Optimization, Register Allocation and Assignment.

Machine-Independent Optimizations: The Principal Sources of Optimizations, Introduction to Data-Flow Analysis.

Suggested Readings:

1. "Compilers–Principles,TechniquesandTools",AlfredV.Aho,RaviSethi,JeffreyD,Ullman,PearsonEducation,2nd Edition, 2006.
2. "CompilerConstruction–PrinciplesandPractice",KennethC.Louden,Thomson,PWSPublishing,1st Edition,1997.
3. "ModernCompilerImplementationC",AndrewW.Appel,CambridgeUniversityPress,RevisedEdition,2004.

Course Code	Course Title						Core/Elective
U23ME609	**Basics Of 3-D Printing**						**PE-2**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**3**	**-**	**-**	**-**	**40**	**60**	**3**

Course Objectives:

The objective of the course is to:

1. To understand the fundamental concepts of 3D Printing, its advantages and limitations.
2. To know the working principle, advantages, disadvantages and applications of liquid, solid and Powder based 3D Printing Technologies.
3. Able to understand the method of manufacturing of liquid based, powder based and solid based techniques.
4. Understand the manufacturing procedure of a prototype using FDM technique.
5. To know diversified applications of 3D Printing Technologies.

Course Outcomes:

After completing the course, the student will be able to:

1. To understand the fundamental concepts of 3D Printing, its advantages and limitations.
2. Understand the working principle and process parameters of 3D printing processes
3. Understand the methodology to manufacture the products using LOM and FDM technologies and study their applications , advantages and case studies
4. To know the working principle, advantages, disadvantages and applications of liquid, solid and Powder based 3D Printing Technologies.
5. To know diversified applications of 3D Printing Technologies.
6. Explore the applications of 3D Printing processes in various fields

Unit-I

Introduction: Prototyping fundamentals: Need for time compression in product development, Historical development, Fundamentals of 3D Printing, 3D Printing Process Chain, Advantages and Limitations of 3D Printing, 3D Printing wheel, Commonly used Terms, Classification of 3D printing processes. Fundamental Automated Processes: Distinction between 3D Printing and Conventional Machining Processes.

Unit-II

Liquid-based 3D Printing Systems: Stereo Lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Polyjet: Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Unit-III

Solid-based 3D Printing System: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT-IV

Powder Based 3D Printing Systems: Working principle, Specifications, Materials used, Process, Applications, Advantages and Disadvantages, Case studies of the following 3D Printing Technologies like Selective laser sintering (SLS), Selective Laser Melting (SLM) and Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS), Electron Beam Melting (EBM).

Unit-V

Applications of 3D Printing : Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Electronic Industry, Jewellery Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules. Biopolymers, Packaging, Disaster Management, Entertainment and Sports industry.

Suggested Reading:

1. Chee Kai Chua and Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” Fifth Edition, World scientific
2. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing-Ian Gibson, David W Rosen, Brent Stucker, Springer, Second Edition, 2010.
3. Rapid Prototyping & Engineering Applications – Frank W.Liou, CRC Press, Taylor & Francis Group, 2011.

Course Code	Course Title						Core/Elective
U23CM6L1 U23CM7L3	**ADVANCED MACHINE LEARNING LAB**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
Java/Python	**-**	**-**	**3**	**3**	**25**	**50**	**1.5**

Course Objectives:

This course enable students to:

1. To implement classification algorithms.
2. To implement regression algorithms.
3. To implement clustering techniques.
4. To implement neural networks.
5. Learn to implement the different protocols

Course Outcomes:

After completing this course, the student will be able to:

6. Implement various protocols using classification and regression techniques.
7. Implement clustering mechanisms
8. Implement Decision trees.
9. Implement and Analyze various random forest techniques.
10. Implement Decision trees.

List of Experiments:

1. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
2. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
3. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
4. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
5. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
6. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data setfor clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem

Suggested Readings:

1. Machine learning, Tom Mitchel, Mc Graw Hill,1997.
2. Introduction to Machine learning ,Jeeva Jose, Khanna book publishing,2020

Course Code	Course Title						Core/Elective
U23IT6L2	**DESIGN AND ANALYSIS OF ALGORITHMS LAB**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Data Structures	**-**	**-**	**3**	**3**	**25**	**50**	**1.5**

Course Objectives:

This course enable students to:

1. Understand problems by applying appropriate algorithms.
2. Analyze the efficiency of various algorithms.
3. Apply techniques of stacks and queues to solve problems.
4. Solve a program in many ways using different techniques.
5. Identify and evaluate complex problems using principles of mathematics and engineering science.

Course Outcomes

On completion of this course, the students are able to:

1. Solve problems by applying appropriate algorithms.
2. Analyze the efficiency of various algorithms.
3. Apply techniques of stacks and queues to solve problems.
4. Develop a program that can be solved in many ways using different techniques.
5. Identify and evaluate complex problems using principles of mathematics and engineering science.

Design, develop and implement the specified algorithms for the following problems using C/Java/python Language

1. Implement a program to sort the elements by using quick sort method.
2. Implement a program to sort the elements by using merge sort method.
3. Obtain the Topological ordering of vertices in a given digraph.
4. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
5. Implement 0/1 Knapsack problem using Dynamic Programming.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
7. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
8. a. Compute the transitive closure of a given directed graph using Warshall's algorithm.
   b. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
9. a. Print all the nodes reachable from a given starting node in a digraph using BFS method.
   b. Check whether a given graph is connected or not using DFS method.
10. Implement N Queen's problem using Back Tracking.

Suggested Readings:

1. "Introduction to the Design and Analysis of Algorithms", Anany Levitin, Pearson Education, Delhi, 2nd Edition, 2007.
2. "Fundamentals of Computer Algorithms", Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran Universities Press, Hyderabad, 2nd Edition, 2007.

Course Code	Course Title						Core/Elective
U23CD6L2	**COMPUTER NETWORKS LAB**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Operating Systems	**-**	**-**	**3**	**3**	**25**	**50**	**1.5**

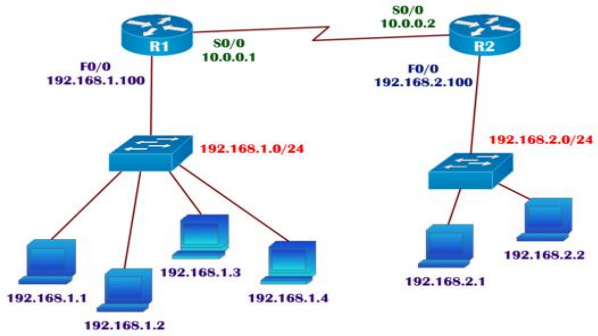
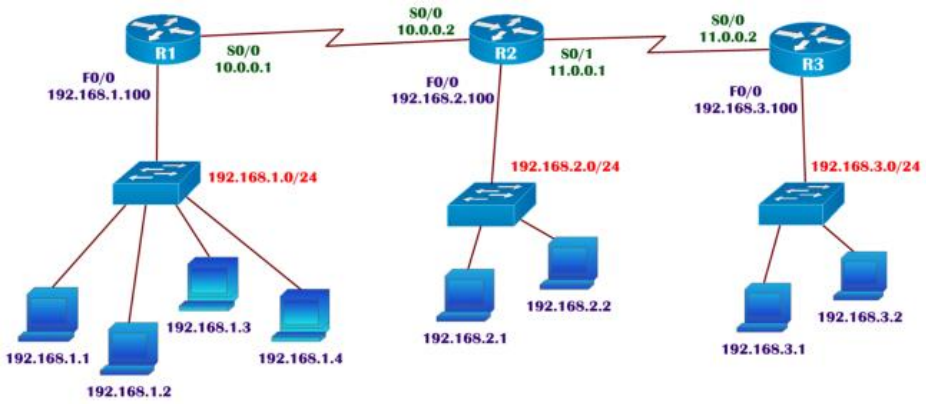
Course Objectives:

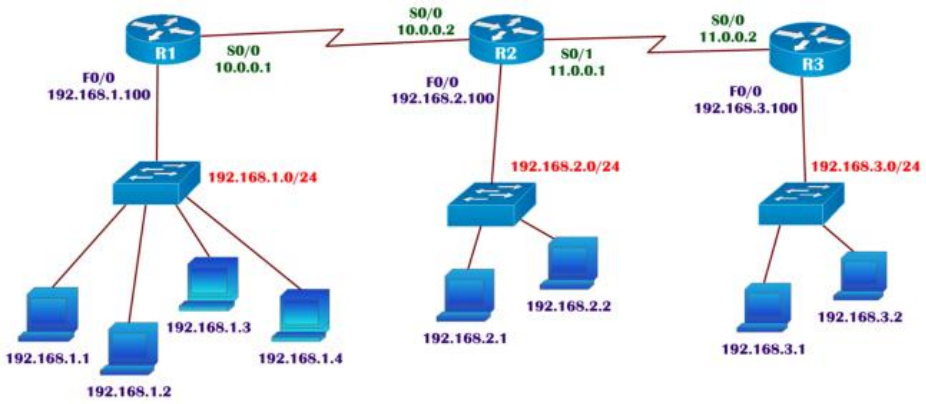
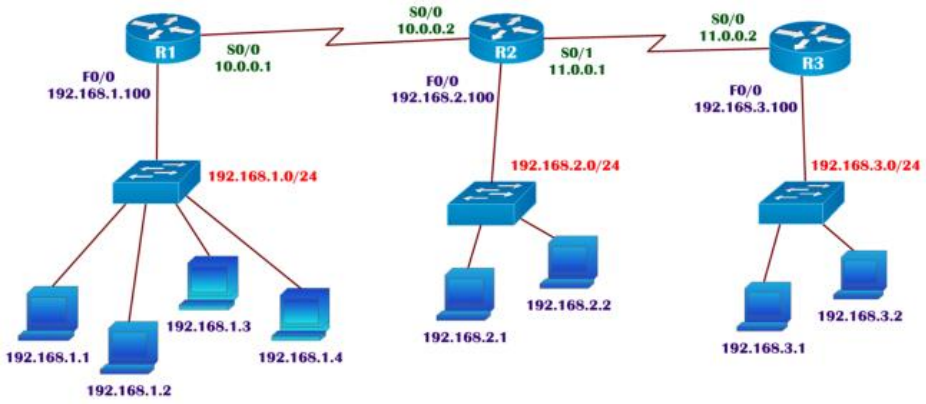
1. To familiarize students with the basic principles, protocols, and layered architecture of computer networks.
2. To reinforce the theory learned in the classroom via hands-on practice.
3. Develop practical skills in network configuration and management
4. To design and implement client-server applications using protocols such as TCP and UDP.
5. To develop simple socket programming applications in languages like C, Java, or Python.

Course Outcomes:

1. Explain and apply basic networking concepts, layered architecture, and protocol operations in practical scenarios.
2. Configure and troubleshoot network devices and design small-scale network topologies.
3. Develop and implement client–server communication using socket programming in TCP and UDP.
4. Simulate and analyze network protocols and topologies using simulation tools .
   Capture, inspect, and analyze network traffic using tools such as Wireshark to understand protocol behavior and performance metrics.

Sr No	Experiment No.	NAME OF THE EXPERIMENT
01	Experiment-01	**Case study about** a) Wireless LAN Configuration b) Cables – Coaxial, Twisted, Fiber Optic c) Cisco Router, Ports of router d) Cisco Switches & Types
02	Experiment-02	**Build a Local Area Networks using Packet Tracer** a) Connect 4 computers in the LAN using Switch b) Configure IP addressing on all PC using 192.168.1.0/24 network c) Check connectivity between all the PÇ's using Ping command, traceroute
03	Experiment-03	**Assigning & verifying IP Address to Router using Packet Tracer** a) Design the topology as per given diagram b) Configure IP Address as diagram & rules c) Verify the interface status using commands

		
04	Experiment-04	**Configuring Static Routing using Packet Tracer** a) Design the topology b) Assign IP address according to diagram c) Make sure that interfaces used should be in UP UP state d) Configure static routing e) Verify routing table and reachability between LAN's (Using PING & TRACE commands) 
05	Experiment-05	**Configuring Default Routing using Packet Tracer** a) Design the topology b) Assign IP address according to diagram c) Make sure that interfaces used should be in UP-UP state d) Configure Default route used on R1 & R3, Static routing on R2 e) Verify routing table and reachability between LAN's (Using PING & TRACE commands)

		
06	Experiment-06	**Configuring Dynamic Routing using Packet Tracer** a) Design the topology b) Assign IP address according to diagram c) Make sure that interfaces used should be in UP UP state d) Configure Dynamic Routing using EIGRP 100 e) Verify routing table and reachability between LAN's (Using PING & TRACE commands) 
07	Experiment-07	**Virtual LAN Configuration on Switches** a) Case study – Creating VLAN, Assigning Ports b) Create four VLAN's (VLAN 10, 20, 30, 40) c) Configure port fa0/8 in to VLAN 10 d) Configure multiple ports (4-7 and 10) into vlan 20
08	Experiment-08	a) Case study - Proxy server, Web server b) Connect all PC's and Printer in LAN in real scenario and test reachability using PING Command

Course Code	Course Title						Core/Elective
U23CM6P1	**MINI PROJECT**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**4**	**4**	**50**	**50**	**2**

Course Objectives:

The objective of the course is to:

1. Enhance practical and professional skills.
2. Familiarize tools and techniques of systematic literature survey and documentation
3. Expose the students to industry practices and team work.
4. Encourage students to work with innovative and entrepreneurial ideas.
5. Make students evaluate different solutions based on economic and technical feasibility

Course Outcomes:

After completing the course, the student will be able to:

1. Formulate a specific problem and give solution
2. Develop model/models either theoretical/practical/numerical form
3. Solve, interpret/correlate the results and discussions
4. Conclude the results obtained
5. Write the documentation in standard format

Guidelines:

1. As part of the curriculum in the VI- semester of the programme each student shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
2. Four students will be allotted to one faculty supervisor for mentoring.
3. Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
4. Mini projects shall have inter-disciplinary/ industry relevance.
5. The students can select a mathematical modelling based/Experimental investigations or Numerical modelling
6. All the investigations should be clearly stated and documented with the reasons/explanations.
7. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and reference.
8. The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.
9. The preliminary results (if available) of the problem may also be discussed in the report.
10. The work has to be presented in front of the PRC committee which consists of one Supervisor and a minimum of two faculty members from the respective Department of the Institute.