CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Model Curriculum(R-20)

OPEN ELECTIVE FOR OTHER PROGRAMME

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
ODD SEMESTER									
1.	20CSO01	Fundamentals of Virtual Reality	3	-	-	3	40	60	3
2.	20CSO02	Introduction to Web Technology	3	-	-	3	40	60	3
3.	20CSO03	Introduction to Soft Computing	3	-	-	3	40	60	3
4.	20CSO04	Open Source Technologies	3	-	-	3	40	60	3
5.	20CSO05	Basics of Artificial Intelligence	3	-	-	3	40	60	3
6.	20CSO06	Fundamentals of Blockchain Technology	3	-	-	3	40	60	3
7.	20CSO07	Fundamentals of Software Engineering	3	-	-	3	40	60	3
EVEN SEMESTER									
8.	20CSO08	Basics of Machine Learning	3	-	-	3	40	60	3
9.	20CSO09	Fundamentals of DBMS	3	-	-	3	40	60	3
10.	20CSO10	Basics of Cyber Security	3	-	-	3	40	60	3
11.	20CSO11	Data Visualization Models	3	-	-	3	40	60	3
12.	20CSO12	Introduction to Mobile Application Development	3	-	-	3	40	60	3
13.	20CSO13	Basics of Cloud Computing	3	-	-	3	40	60	3
14.	20CSO14	Fundamentals of Computer Vision	3	-	-	3	40	60	3

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

20CSO01

FUNDAMENTALS OF VIRTUAL REALITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Fundamentals of C++.

Course Objectives: The main objectives of this course are,

1. To introduce hardware and software components of virtual reality.
2. To provide knowledge about geometry of virtual worlds.
3. To give an overview of visual physiology, perception and audio in VR.
4. To explore the applications of VR in areas like defense and education.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Define Virtual Reality and describe the components of a VR system, input and output devices of virtual reality systems.
2. Apply geometric modeling to model real world scenarios.
3. Develop interfaces by using visual physiology, visual perception and audio.
4. Evaluate virtual reality systems for usability.
5. Explore the applications of VR systems in defense and telerobotics.

UNIT - I

Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system.

Input Devices: Trackers, Navigation and Gesture Interfaces: Three-dimensional position trackers, navigation and manipulation interfaces, Gesture interfaces.

Output Devices: Graphics displays, sound displays and haptic feedback.

UNIT - II

Modeling: Geometric modeling, kinematics modeling, physical modeling, behaviour modeling, model management.

Human Factors: Methodology and terminology, user performance studies, VR health and safety issues, VR and Society.

UNIT - III

Light and Optics: Basic Behaviour of light, Lenses, Optical aberrations, The Human eye, Cameras, Displays.

Physiology of Human Vision: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye movements, Implications for VR. **Visual Perception:** Depth perception, Motion perception, Color Perception.

UNIT - IV

Audio: The Physics of Sound, the Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

Evaluating VR Systems and Experiences: Perceptual Training, Recommendations for Developers, Comfort and VR Sickness, Experiments on Human Subjects.

UNIT – V

Applications of Augmented and Virtual Reality: Gaming and Entertainment, Architecture and Construction, Science and Engineering, Health and Medicine, Aerospace and Defense, Education, Information control and Big Data Visualization, Telerobotics and Telepresence. Human Factors Considerations, Legal and Social Considerations, the Future: Short-term Outlook and Long-term Outlook

Text Books:

1. Gregory C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Second Edition, John Wiley & Sons, Inc., 2003.
2. Steven M. LaVelle, "Virtual Reality", Cambridge University Press, 2019.
3. Steve Aukstakalnis, "Practical Augmented Reality", Addison-Wesley, 2016.

Suggested Reading:

1. George Mather,"Foundations of Sensation and Perception", Second Edition, Psychology Press, 2009.
2. Peter Shirley, Michael Ashikhmin, and Steve Marschner, "Fundamentals of Computer Graphics", Third Edition, A K Peters/CRC Press, 2009.
3. K. S. Hale and K. M. Stanney, "Handbook on Virtual Environments", 2nd edition, CRC Press, 2015.

Online Resources:

1. http://msl.cs.uiuc.edu/vr/
2. https://nptel.ac.in/courses/106106139/

20CSO02

INTRODUCTION TO WEB TECHNOLOGY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. To acquire knowledge on XHTML, Java Script and XML to develop client side web applications.
2. To learn developing web applications using PHP.
3. To understand the database access through the web.

Course Outcomes: On successful completion of the course, students will be able to,

1. Understand the technologies required for developing web application.
2. Identify and choose XHTML tags, CSS and java scripts to develop well-structured and easily maintained web pages.
3. Design and Develop interactive and innovative web pages using various platforms/technologies like XHTML, CSS, XML, JAVASCRIPT.
4. Create and deploy web applications in web server by using server-side programming concepts like PHP
5. Build a data driven web site using Databases.
6. Evaluate different web applications to implement optimal solutions for real time problems

UNIT - I

Fundamentals: Introduction to the Internet, WWW Browsers, Web Servers, URL, MIME, HTTPS.
Introduction XHTML: Basic Syntax Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists Tables, Forms, Cascading Style Sheets.

UNIT - II

Bootstrap: Introduction to bootstrap.
XML: Introduction, uses of XML, the Syntax of XML, XML Document Structure, DTD, Namespaces, XML schemas, displaying Raw XML Documents, displaying XML documents with CSS, XSLT style Sheets.

UNIT - III

The Basics of Java script: Primitive operations and Expressions, Arrays, Functions, Pattern Matching Using Regular Expressions, Document Object Model, Element Access in JavaScript, Events and Event Handling, Handling Events from Body, Button, Text Box and Password Elements.
Dynamic Documents with Java Script: Positioning Elements, Moving Elements, Changing Colors and Fonts, Dynamic Content.

UNIT - IV

Introduction to PHP: Overview of PHP, General Syntactic Characteristics, Primitives, Operations, and Expressions, Output, Control Statements. Arrays, Functions, Pattern Matching, Form Handling, Cookies, Session Tracking.

UNIT - V

Database Access through the Web: Relational Databases, an Introduction to the Structured Query Language, Architectures for Database Access, the MySQL Database System.
Introduction to PHP MyAdmin, connection to MySQL server from PHP, execution of MySQL queries from PHP, receiving data from database server and processing it on webserver using PHP.

Text Books:

1. M. Deitel, P.J. Deitel, A. B. Goldberg, “Internet and World Wide Web How to program”, Pearson Education, 3rd edition, 2003.
2. Robert W. Sebesta, “Programming the World Wide Web”, Pearson Education, 4th Edition, 2008.
3. Adams, “PHP Programming the Complete Guide”, 2022.

Suggested Reading:

1. Chris Bates, “Web Programming: building internet applications”, Wiley, Second edition, 2002.
2. Steven Holzner, “The Complete Reference PHP”, McGraw Hill Education; Raunak PHP study edition, 2017.

20CSO03

INTRODUCTION TO SOFT COMPUTING
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Linear algebra and calculus.

Course Objectives: The objectives of this course are,

1. To learn various types of soft computing techniques and their applications.
2. To acquire the knowledge of neural network architectures, learning methods and algorithms.
3. To understand Fuzzy logic, Genetic algorithms and their applications.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Illustrates various soft computing techniques.
2. Analyze and design various learning models.
3. Apply the Neural Network Architecture for various Real time applications.
4. Apply approximate reasoning using fuzzy logic.
5. Analyze and design Genetic algorithms in different applications.
6. Apply soft computing techniques to solve different applications.

UNIT - I

Soft computing vs. Hard computing, Various types of soft computing techniques.
Artificial Neural Networks: Fundamental concepts, Evolution of neural networks, Basic models of artificial neural network,important terminologies of ANNs. McCulloch-Pitts neuron, linear separability, Hebb network.

UNIT - II

Supervised Learning Neural Networks: Perceptron networks, Adaptive linear neuron (Adaline), Multiple Adaptive linear neuron (Madaline), Back propagation network.

UNIT - III

Unsupervised Learning Neural Networks: Kohonen Self Organizing networks, Adaptive resonance theory.
Associate Memory Networks: Bidirectional associative memory network, Hopfield networks.

UNIT - IV

Fuzzy Logic: Introduction to classical sets and Fuzzy sets, Fuzzy relations, Tolerance and equivalence relations, Membershipfunctions, Defuzzification.

UNIT - V

Genetic Algorithms: Introduction, Basic operators and terminology, Traditional algorithm vs. genetic algorithm, Simple genetic algorithm, General genetic algorithm, Classification of genetic algorithms.

Text Books:

1. S.N. Sivanandam& S.N. Deepa, “Principles of soft computing”, Wiley publications, 2nd Edition, 2011.

Suggested Reading:

1. S. Rajasekaran& G.A. Vijayalakshmipai, “Neural Networks, Fuzzy logic & Genetic Algorithms, Synthesis & Applications”, PHI publication, 2008.
2. LiMin Fu, “Neural Networks in Computer Intelligence”, McGraw-Hill edition, 1994.
3. K.L.Du& M.N.S Swamy, “Neural Networks in a Soft Computing Framework”, Springer International edition, 2008.
4. Simon Haykins, “Neural Networks a Comprehensive Foundation”, PHI, second edition.
5. Goldberg, David E., “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, New Delhi, 2002.
6. N.P. Padhy and S.P. Simon,”Soft Computing: With Matlab Programming”, Oxford University Press, 2015.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc18_cs13/preview.
2. https://archive.nptel.ac.in/courses/106/105/106105173/

20CSO04

OPEN SOURCE TECHNOLOGIES
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. To become familiar with Open Source Technologies.
2. To understand the principles and methodologies of OSS.
3. To understand the policies, licensing procedures and ethics of OSS.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Differentiate between Open Source and Proprietary software and Licensing.
2. Identify the applications, benefits and features of Open Source Technologies.
3. Evaluate open source project and management tools like Linux, Apache, and GIT.
4. Adapt to the usage of Open source tools and technologies.
5. Analyze the Social and Financial impact of Open source technology on Governance, Teaching and Business
6. Practice Open Source principles, ethics and models.

UNIT - I

Introduction to Open Source: Open Source, need of Open Source, Open Source Principles, Open Source Standards Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Software Vs. Proprietary Software, Public Domain software, History of free software, Proprietary Vs Open Source Licensing Model, use of Open Source Software.

UNIT - II

Fault Tolerant Design: Principles and Open Source Methodology- History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open Source Software Development, Licenses, Copyright vs. Copyleft, Patents, zero marginal cost, income-generation Opportunities, Internationalization.

UNIT - III

Case Studies: Apache, BSD, Linux, Mozilla Firefox, Wikipedia, Git, GNU CC, Libre Office.

UNIT - IV

Open Source Project: Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open Source Teaching (OST), Open Source Media, What Is A License, How to create your own Licenses. Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent.

UNIT - V

Open Source Ethics- Open Source Vs. Closed Source, Open Source Government, Ethics of Open Source, Social and Financial Impact of Open Source Technology, Shared Software, Shared Source, Open Source as a Business Strategy.

Text Books:

1. KailashVadera, Bjhavesh Gandhi “Open Source Technology”, University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, “Open Source Technology and Policy”, Cambridge University Press.

Suggested Reading:

1. Wale Soyinka, “Linux Administration- A beginner‟s Guide”, Tata McGraw Hills.
2. Andrew M. St. Laurent, “Understanding Open Source and Free Software Licensing”, O'Reilly Media.
3. Dan Woods, Gautam Guliani, “Open Source for the Enterprise”, O'Reilly Media.
4. Bernard Golden, “Succeeding with Open Source”, Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, “Perspectives on Free and Open Source Software”, MIT press

Online Resources:

1. https://fossee.in/
2. https://opensource.com
3. https://www.gnu.org/

20CSO05

BASICS OF ARTIFICIAL INTELLIGENCE
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. To learn fundamental concepts in Artificial Intelligence.
2. To explore various paradigms involved in solving AI problems involving perception, reasoning and learning.
3. To apply AI concepts for building an expert system to solve the real-world problems.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Differentiate between a rudimentary Problem and an AI problem, its Characteristics and problem-solving Techniques.
2. Compare and contrast the various knowledge representation schemes of AI.
3. Appraise knowledge in Uncertainty and Probabilistic reasoning approaches.
4. Understand the different learning techniques.
5. Apply the AI techniques to solve the real-world problems.

UNIT - I

Introduction: History Intelligent Systems, Foundations of Artificial Intelligence, Sub areas of Al, Applications. **Problem Solving - State - Space Search and Control Strategies:** Introduction, General Problem Solving Characteristics of problem, Exhaustive Searches, Heuristic Search Techniques, Iterative - Deepening A*, Constraint Satisfaction.

UNIT - II

Logic Concepts and Logic Programming: Introduction, Propositional Calculus Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Table, A System in Propositional Logic, Resolution, Refutation in Propositional Logic, Predicate Logic, Logic Programming.

Knowledge Representation: Introduction, Approaches to knowledge Representation, Knowledge Representation using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation using Frames.

UNIT - III

Uncertainty Measure - Probability Theory: Introduction, Probability Theory, Bayesian Belief Networks, Certainty Factor Theory, Dempster - Shafer Theory.

UNIT - IV

Intelligent Agents: Agents vs Software programs, classification of agents, Multi- agent systems, Architecture of intelligent agents, Multi-agent application.

Expert System and Applications: Introduction, Phases in Building Expert Systems Expert System Architecture, Expert Systems Vs Traditional Systems, Truth Maintenance Systems, Application of Expert Systems, List of Shells and tools.

UNIT - V

Machine - Learning Paradigms: Introduction, Machine learning System, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees, Deductive Learning, Clustering, Support Vector Machines

Text Books:

1. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, First Edition, 2011.
2. Russell, Norvig, “Artificial Intelligence: A Modern Approach”, Pearson Education, 3rd Edition, Prentice Hall.

Suggested Reading:

1. Rich, Knight, Nair, “Artificial Intelligence”, Tata McGraw Hill, 3rd Edition, 2009.
2. Trivedi, M.C., “A Classical Approach to Artificial Intelligence”, Khanna Publishing House, Delhi.

Online Resources:

1. https://nptel.ac.in/courses/106105077
2. https://nptel.ac.in/courses/106106126

20CSO06

FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. To provide the basic concepts and architecture of Blockchain.
2. To interpret the working of Ethereum and Hyperledger Fabric.
3. To explore the applications of Blockchain in financial and government sectors.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Understand the concepts of distributed systems and Blockchain properties.
2. Learn about the significance of bitcoin ecosystem.
3. Understand consensus mechanisms and technologies that support ethereum.
4. Learn about Hyperledger Fabric and its architecture.
5. Analyze blockchain use cases in financial software systems and government sectors.

UNIT - I

Introduction: Overview of distributed systems; Introduction to Blockchain; Properties of Blockchain; Evolution of Blockchain.

Cryptocurrency and Block chain: Anonymity and Pseudonymity in Cryptocurrency; Programmable Money; Hash Functions and Merkle Trees; Components of Blockchain Ecosystem; Cryptography and Consensus Algorithms; Types of Blockchain; Blockchain Platforms.

UNIT - II

Bitcoin Platform: Bitcoin and its uses; Bitcoin Ecosystem; Structure of a Bitcoin Transaction; Nodes in a Bitcoin Network; Bitcoin Mining, Bitcoin Economics; Types of bitcoin Mining; Consensus mechanism in bitcoin.

UNIT - III

Introduction to Ethereum: What is Ethereum; Introducing Smart Contracts; Cryptocurrency in Ethereum; Mining in Ethereum; Consensus mechanism in Ethereum; Technologies that support Ethereum; Ethereum Programming Language; Ethereum Test Networks.

UNIT - IV

Hyperledger Fabric: Introduction to Hyperledger Fabric; Hyperledger Fabric architecture; Consensus in Hyperledger Fabric; Hyperledger API and Application Model; Setting up Development Environment using Hyperledger Composer tool.

UNIT - V

Blockchain in Financial Software Systems (FSS): Settlements, KYC; **Blockchain for Government:** Digital identity, land records and other kinds of record keeping between government entities.

Text Books:

1. Andreas M. Antonopoulos, “Mastering Bitcoin. Programming the Open Blockchain”, O’Reilly, 2017.
2. Ghassan Karame, Elli Androulaki, “Bitcoin and Blockchain Security”, Artech House, 2016.
3. Vikram Dhillon, “Blockchain Enabled Applications”, et al, Apress, 2019.

Suggested Reading:

1. Mark Gates, “Blockchain: Ultimate guide to understanding blockchain, bitcoin, cryptocurrencies, smart contracts and the future of money”, Wise Fox Publishing and Mark Gates, 2017.
2. Melanie Swan, “Blockchain “, O’Reilly Media Inc., 2015.

Online Resources:

1. Blockchain Applications- https://www.blockchain-books.com
2. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric

3. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, DavidSmits, 2017. (https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html)
4. https://onlinecourses.nptel.ac.in/noc18_cs47/preview
5. https://www.udemy.com/blockchain-and-bitcoin-fundamentals/

20CSO07

FUNDAMENTALS OF SOFTWARE ENGINEERING
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Programming for problem solving.

Course Objectives: The objectives of this course are,
1. To learn the fundamental concepts in software development.
2. To impart knowledge on various phases of software development.
3. To impart knowledge on software testing strategies and quality assurance activities.

Course Outcomes: On Successful completion of this course, student will be able to,
1. State the software process and the perspective process models and agile process models.
2. Interpret the Requirements of Software Product and demonstrate the skills necessary to specify the requirements of software product.
3. Recall the software architecture and design principles of software product.
4. Construct a product using coding principles and Outline the testing strategies for conventional and O-O Software.
5. Apply software testing methods like White Box, Black box and explore the corrective, adaptive, and enhancive software maintenance categories.

UNIT - I

The Software Problem, Software Processes- Process and Project, Components of software Processes. **Software Development Process Models**: Waterfall, Prototyping, Iterative Development, RUP, Time Boxing Model.
Agile Process: Agility, Agile Process Model – Extreme Programming, Using Process Models in a Project.

UNIT - II

Software Requirements Analysis Specification: Value of a Good SRS, Requirements Process, Requirements Specification, Functional Specification with Use-cases, other approaches for Analysis- DFD, E-R. **Planning a Software Project**: Project schedule and staffing, Quality Planning, Risk Management Planning, Project Monitoring Planning.

UNIT - III

Software Architecture: Architecture views, Component and Connector views, Architecture Styles for C&C views. Design: Design Concepts, Function Oriented Design, Object Oriented Design, Detailed Design.

UNIT - IV

Coding: Programming Principles and Guidelines, Incrementally developing code, Managing Evolving code, Code Inspection. **Testing Strategies**: A Strategic approach to software testing, strategic issues, test strategies for Conventional and O-O Software, Validation Testing, System Testing.

UNIT - V

Testing Tactics: Software Testing Fundamentals, White Box Testing: Basis Path Testing, Control Structure Testing. Black Box Testing. **Software Maintenance**: Categories of Maintenance.

Text Books:
1. Pankaj Jalote, “A concise introduction to software Engineering”, Springer, 2008.
2. Roger S.Pressman, “Software Engineering: A Practitioner’s Approach”, 7th Edition, McGraw Hill, 2009.
3. Nasib Singh Gill, “Software Engineering”, Khanna Publishing House, 2007.

Suggested Reading:
1. Roger S.Pressman, “Software Engineering: A Practitioner’s Approach”, 7th Edition, McGraw Hill, 2009.
2. Ali Behforooz and Frederick J.Hudson, “Software Engineering Fundamentals”, Oxford University Press, 1996.

Online Resources:
1. https://nptel.ac.in/courses/106101061/

20CSO08

BASICS OF MACHINE LEARNING
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. To learn Machine Learning algorithms.
2. To learn to work with data's, preparing datasets for real world problems
3. To study various machine learning algorithms.
4. To analyze data using machine learning techniques.
5. To become familiar with usage of time series and deep learning approaches.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Define the basic concepts related to Python and Machine Learning
2. Describe the feature engineering methods, regression techniques and classification methods
3. Apply Python packages for data visualization, text and time series data analysis using NLP toolkit
4. Evaluate and interpret the results of the various machine learning techniques
5. Solve real world problems using deep learning framework.

UNIT - I

Introduction to Machine Learning: Introduction, types of learning, Machine Learning process.
Introduction to Python: Features, sources and installation of Python, IDEs, Basics of Python, Data Structures and loops.

UNIT - II

Feature Engineering: Introduction to Features and need of feature Engineering, Feature extraction and selection, Feature Engineering Methods, Feature Engineering with Python. Principal component analysis (PCA).
Data Visualization: Various charts, histograms, plots.

UNIT - III

Regression: Simple and multiple regressions, Model assessment, various types of errors, errors, ridge regression, Lasso regression, non-parameter regression.
Classification: Linear classification, logistic regression, Decision Trees, Random Forest, Naïve Bayes, Support Vector Machines (SVM).

UNIT - IV

Unsupervised Learning: Clustering, types of clustering, K-Means clustering, Hierarchical clustering.
Text Analysis: Basic text analysis with Python, regular expressions, NLP, text classification.
Time Series Analysis: Date and time handling, window functions, correlation, time series forecasting

UNIT - V

Neural Network and Deep Learning: Neural network- gradient descent, activation functions, parameter initialization, optimizer, loss function, deep learning, deep learning architecture, memory, deep learning framework.
Recommender System: Recommendation engines, collaborative filtering.

Text Books:

1. Abhishek Vijavargia "Machine Learning using Python", BPB Publications, 1st Edition, 2018.
2. Tom Mitchel "Machine Learning", Tata McGraw Hill, 2017.

Suggested Reading:

1. Marsland, S. "Machine Learning: An Algorithmic Perspective" 1st Edition, Chapman and Hall/CRC, 2009. https://doi.org/10.1201/9781420067194
2. Yuxi Liu, "Python Machine Learning by Example", 2nd Edition, PACT, 2017.

Online Resources:

1. https://www.guru99.com/machine-learning-tutorial.html
2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
3. https://www.tutorialspoint.com/python/
4. https://docs.python.org/3/tutorial/
5. https://www.geeksforgeeks.org/machine-learning/

20CSO09

FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. To learn data models, conceptualize and depict a database system using E-R diagrams.
2. To understand the internal storage structures in a physical DB design.
3. To learn the fundamental concepts of transaction processing techniques.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS. Design the database logically using ER modeling
2. Outline the schema of the relational database and key constraints. Develop queries using DDL, DML and DCL of SQL.
3. Identify the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.
4. Summarize the concepts of dense, sparse, ISAM and B+ tree indexing and get familiar with states and properties of transactions.
5. Interpret the locking, time stamp, graph and validation-based protocols for concurrency control.
6. Summarize log-based recovery techniques to increase the robustness of the database, identify to resolve the deadlocks in the transactions.

UNIT - I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures.
Database Design and E-R Model: Basic concepts, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys.
Structured Query Language: Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT - III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT - IV

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files.
Transaction Management: Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT - V

Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols.
Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery.
Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill International Edition, 2011.

2. Date CJ, Kannan A, Swamynathan S, “An Introduction to Database Systems”, Eight Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, JohnnesGehrke, “Database Management Systems”, Third Edition, McGraw Hill, 2003.
2. RamezElmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, “Fundamentals of Database Systems”, Fourth Edition, Pearson Education, 2006.

20CSO10

BASICS OF CYBER SECURITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Programming for problem solving.

Course Objectives: The objectives of this course are,

1. To understand how to identify, analyze and remediate computer security breaches by learning and implementing the real-world scenarios in Cyber Investigations
2. To exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an organization.
3. To practice with an expertise in academics to design and implement security solutions.
4. To understand key terms and concepts in Cryptography, Governance and Compliance and Develop cyber security strategies and policies.
5. To understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Analyze and evaluate the cyber security needs of an organization.
2. Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
3. Measure the performance and troubleshoot cyber security systems.
4. Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.
5. Applying operational and cyber security strategies and policies.

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An IndianPerspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber offenses: How Criminals Plan Them · Introduction · How Criminals Plan the Attacks · Social Engineering · Cyber stalking · Cybercafé and Cybercrimes. Cloud Computing Cybercrime: Mobile and WirelessDevices · Introduction · Proliferation of Mobile and Wireless Devices · Trends in Mobility · Credit Card Fraudsin Mobile and Wireless Computing Era ·

UNIT - III

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors.
Steganography · DoS and DDoS Attacks · SQL Injection · Buffer Overflow · Attacks on Wireless Networks Phishing and Identity Theft · Introduction · Phishing · Identity Theft (ID Theft) Cybercrimes and Cybersecurity:The Legal Perspectives.

UNIT - IV

Cyber Security: The Legal Perspectives: Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT – V

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics. Introduction · Cost of Cybercrimes and IPR Issues: Lessons for Organizations · Web Threats for Organizations: The Evils and Perils.

Text Books:

1. Sunit Belapure Nina gobole, “Cyber Security”, Wiley, 2011.
2. Lester Evans, “Cyber security: An Essential Guide to Computer and Cyber Security for Beginners”, Bravex Publications, 2020.

Suggested Reading:

1. Prof Amit Garg, Dr Krishan Kumar Goyal, “Cyber Security”, Laxmi Publications, 2022.
2. Zach Codings, “Cyber Security: Hacking with Kali Linux, Ethical Hacking”, 2019.
3. Noah Zhang, Dana Onyshko, “Cyber Security: The Beginners Guide to Learning the Basics of Information Security and Modern Cyber Threats”, Kindle Edition.

Online Resources:

1. https://nptel.ac.in/courses/106106129
2. https://uou.ac.in/foundation-course
3. https://nptel.ac.in/courses/106105162

20CSO11

DATA VISUALIZATION MODELS
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. To learn various types of data.
2. To acquire the knowledge on Non-spatial and spatial data visualization
3. To understand visualization fundamentals and web data visualization.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Illustrate the modeling of various types of data.
2. Understand the visualization fundamentals.
3. Apply methods and tools for Non – spatial Data Visualization.
4. Apply methods for spatial data visualization.
5. Apply methods for web data visualization.

UNIT - I

Data Modeling: Conceptual models, Spread sheet models, Relational Data Models, object oriented models, semi structured data models, unstructured data models.

UNIT - II

Visualization Fundamentals, Design principles, The Process of Visualization, Data Abstraction, Visual Encodings, Use of Color, Perceptual Issues, Designing Views, Interacting with Visualizations, Filtering and Aggregation, Design Studies Information.

UNIT - III

Non-Spatial Data Visualization, Tabular Data, Tree Data, Graph Data, Text Data, Flow Data, Time-Series Data, Topological Visualization, Uncertainty, Visual Analytics.

UNIT - IV

Scientific /Spatial Data Visualization, Scalar Volumes, Isosurfacing, Volume Rendering, Transfer Function Design, Vector Fields, Maps, Spatial Uncertainty.

UNIT - V

Web data visualization: web structure data, web usage data, web content data multimedia data visualization.

Text Books:

1. Ben Fry, “Visualizing Data” O'Reilly Media, Inc., 2007.
2. Tamara Munzner, “Visualization Analysis and Design”, A K Peters/CRC Press, 2014.
3. Colin Ware, “Information Visualization: Perception for Design”, Morgan Kaufmann; 3rd edition, 2012.

Suggested Reading:

1. Paulraj Ponniah, “Data Modeling Fundamentals”, a Practical Guide for IT Professionals, Wiley-Inter science; 1st edition, 2007.

Online Resources:

1. https://www.coursera.org/learn/datavisualization/home/welcome
2. https://www.coursera.org/learn/data-visualization-tableau/home/welcome
3. https://www.udemy.com/course/learning-python-for-data-analysis-and-visualization/learn/lecture/2345238?start=0#overview
4. https://onlinecourses.nptel.ac.in/noc16_cs03/preview

20CSO12

INTRODUCTION TO MOBILE APPLICATION DEVELOPMENT
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. To learn the fundamentals of Android operating systems.
2. To apply skills using Android software development tools.
3. To be able to develop software with reasonable complexity on mobile platform.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Interpret and analyze android platform architecture and features to learn best practices in android programming.
2. Design the User Interface for mobile applications.
3. Apply Intents, broadcast receivers and Internet services in android app.
4. Develop database management system to retrieve and/or store data for mobile application.
5. Evaluate and select appropriate android solutions to the mobile computing platform.
6. Build android applications for complex problems.

UNIT - I

Introduction to Android Operating System: Android SDK Features, Developing for Android, Best practices in Android programming, Android Development Tools. Android application components – Android Manifest file, Externalizing resources, The Android Application Lifecycle, A Closer Look at Android Activities.

UNIT - II

Android User Interface: Introducing Layouts, User Interface (UI) Components – Editable and Non Editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers. Event Handling – Handling clicks or changes of various UI components. Introducing Fragments, Multi-screen Activities.

UNIT - III

Intents and Broadcasts: Introducing Intents: Using Intents to Launch Activities. Using Intent to dial a number or to send SMS. **Broadcast Receivers** –Creating Intent Filters and Broadcast Receivers: Using Intent Filters to Service Implicit Intents. Finding and using Intents received within an Activity. Customizing the Action Bar, Using the Action Bar for application navigation, Notifications – Creating and Displaying notifications, Displaying Toasts.

UNIT - IV

Persistent Storage: Files – Reading data from files, listing contents of a directory, Creating and Saving Shared Preferences, Retrieving Shared Preferences. Database –Introducing Android Databases, Introducing SQLite, Content Values and Cursors, Working with SQLite Databases. Registering Content Providers, Using content Providers (insert, delete, retrieve and update).

UNIT - V

Advanced Topics: Alarms –Using Alarms. Using Internet Resources – Connecting to internet resource, using download manager. Location Based Services –Using Location-Based Services, Using the Emulator with Location-Based Services.

Text Books:

1. Reto Meier, "Professional Android 4 Application Development", Wiley India, (Wrox), 2012
2. O'Reilly Dawn Griffiths, David Griffiths "Head First Android Development" , O'Reilly Media, Inc., 2015.

Suggested Reading:

1. Wei-Meng Lee, "Beginning Android 4 Application Development", Wiley India (Wrox), 2013.
2. David Wolber, Hal Abelson, Ellen Spertus & Liz Looney, "App Inventor-Create your own Android Apps", O'Reilly, 2011.

20CSO13

BASICS OF CLOUD COMPUTING
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Objectives: The objectives of this course are,

1. To understand the concept of cloud computing.
2. To appreciate the evolution of the cloud from the existing technologies.
3. To have knowledge of the various issues in cloud computing.
4. To be familiar with the lead players in the cloud.
5. To appreciate the emergence of the cloud as the next-generation computing paradigm.

Course Outcomes: On Successful completion of this course, student will be able to,

1. Define the main concepts, key technologies, strengths, and limitations of cloud computing.
2. Develop the ability to understand and use compute and storage cloud architecture, service, and delivery models.
3. Understanding the virtualization and enabling technologies that help develop the cloud.
4. Explain the core issues of cloud computing such as resource management and security.
5. Evaluate and choose the appropriate technologies, and approaches for implementing and using the cloud.

UNIT - I

Introduction To Cloud: Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing -Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

UNIT - II

Cloud Architecture and Services: Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges

UNIT - III

Virtualization: Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU -Memory – I/O Devices – Virtualization Support and Disaster Recovery.

UNIT - IV

Resource Management and Security in Cloud: InterCloud Resource Management – Resource Provisioning and Resource Provisioning Methods– Cloud Security Challenges –Software-as-a-Service Security – Security Governance – Virtual Machine Security

UNIT - V

Cloud Technologies and Advancements: Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation –Federated Services and Applications – Future of Federation.

Test Books:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome,"Cloud Computing: Implementation, Management and Security", CRC Press, 2017.
3. Jaden Locus "**cl**oud Computing for Beginners with Examples", Kindle Edition, 2019.

Suggested Reading:

1. Lisdorf, Anders "Cloud computing Basics: A Non-Technical Introduction" published 2021.
2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.

3. Thomas Erl and Zaigham Mohamood “Cloud Computing: Concepts, Technology & Architecture”, The Pearson Service Technology Series, published 2013.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach”, Tata McGraw Hill, 2009.

Online Resources:

1. https://1library.net/document/ozl74rry-mastering-cloud-computing-rajkumar-buyya-pdf.html
2. Mastering Cloud Computing Rajkumar Buyya pdf (1library.net)
3. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things by Kai Hwang (goodreads.com)
4. https://www.goodreads.com/book/show/19649262-distributed-and-cloud-computing

20CSO14

FUNDAMENTALS OF COMPUTER VISION
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	

Course Objectives: The objectives of this course are,
1. To understand the Fundamental Concepts Related to Multi-Dimensional Signal Processing.
2. To understand Feature Extraction algorithms.
3. To understand Visual Geometric Modeling and Stochastic Optimization.

Course Outcomes: On Successful completion of this course, student will be able to,
1. Recognize the basic fundamentals of vision and describe the scope of challenges.
2. Develop algorithms to analyze feature detection and feature alignment.
3. Analyze images and videos for problems such as tracking and structure from motion.
4. Choose object, scene recognition and categorization algorithms for real time images.
5. Apply various techniques to build computer vision applications.

UNIT - I

Introduction to Computer Vision and Image Formation: Introduction, Geometric primitives and transformations, Photometric image formation, Digital Camera image formation.
Image Processing: Point operators, linear filtering, more neighborhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations.

UNIT - II

Feature detection and matching: Points and patches, Edges, Lines.
Segmentation: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts.
Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation.

UNIT - III

Structure from motion: Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, constrained structure and motion.
Dense motion estimation: Translational alignment, parametric motion, Spline-based motion, Optical flow, Layered motion.

UNIT - IV

Image Stitching: Motion Models, Global alignment, Sparse and dense corresponding, Global Optimization.

UNIT – V

Recognition: Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding.

Text Books:
1. Richard Szeliski “Computer Vision: Algorithms and Applications”, Springer-Verlag London Limited, 2011.
2. R. C. Gonzalez and R. E. Woods, “Digital Image Processing”; Addison Wesley, 2008.

Suggested Reading:
1. Robert J. Schallkoff, “Pattern Recognition: Statistical. Structural and Neural Approaches”, John Wiley and Sons; 1992+.
2. D. A. Forsyth and J. Ponce, “Computer Vision: A Modern Approach”, Pearson Education, 2003.
3. R. Hartley and A. Zisserman, “Multiple View geometry”, Cambridge University Press, 2002.
4. Richard Hartley and Andrew Zisserman, “Multiple View Geometry in Computer Vision”, Second Edition, Cambridge University Press, March 2004.
5. K. Fukunaga; “Introduction to Statistical Pattern Recognition”, Second Edition, Academic Press, Morgan Kaufmann, 1990.

Online Resources / Weblinks / NPTEL Courses:

1. CV online: http://homepages.inf.ed.ac.uk/rbf/CVonline
2. Computer Vision Homepage:
3. http://www2.cs.cmu.edu/afs/cs/project/cil/ftp/html/vision.html