



School of Computer Science & IT Devi Ahilya Vishwavidyalaya

SYLLABUS

MCA 2 years

Program Educational Objectives (PEOs)

- PEO 1:** Nurture through in-depth knowledge of fundamental computing concepts and programming along with supplementary skills to bridge industry-academia gap.
- PEO 2:** Develop proficiency in application-based projects through latest technological trends.
- PEO 3:** Inculcate professional values with ethics to pursue career in industry or academia.

Program Specific Outcomes (PSOs)

- PSO 1:** Understand, analyze and develop computer programs in the areas related to algorithm, web design and machine learning for designing efficient software system.
- PSO 2:** Apply standard software engineering practices and strategies in software project development using modern computing tools and techniques with concern for societal, environmental, and cultural aspects.
- PSO 3:** Learn various issues, latest trends in technology development and thereby innovate new ideas and solutions to existing problems.

III - SEMESTER

CS-5517: Automata Theory and Compiler Construction

Aim:

This course provides students with the theoretical foundation to understand and analyze discrete computing systems, alongside practical skills for designing and implementing compilers.

Course Outcomes:

- CO 1: Analyze the fundamentals of automata theory and formal languages.
 - CO 2: Design and implement finite automata and context-free grammars.
 - CO 3: Understand the structure and phases involved in compiler construction.
 - CO 4: Apply parsing techniques to develop syntax analyzers.
 - CO 5: Implement optimization techniques for efficient code generation.
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Unit-I

Introduction: Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), Equivalence of NFA and DFA, Minimization of Finite Automata, Regular Expressions, Language, CFG (Context free grammar).

Unit-II

Compiler Structure: Compilers and Translators, Various Phases of Compiler, Lexical Analysis: The role of Lexical Analyzer, A simple approach to the design of Lexical Analyzer, Implementation of Lexical Analyzer, LMD, RMD Derivation and Parse tree, Ambiguity, Capabilities of CFG.

Unit-III

Basic Parsing Techniques: Top-Down parsers with backtracking, Recursive, Descent Parsers, Predictive Parsers. Bottom-up Parsers, Shift-Reduce Parsing, Operator Precedence Parsers, LR Parsers (SLR, Canonical LR, LALR), Syntax Analyzer Generator: YACC (Yet Another Compiler Compiler).

Unit-IV

Semantic Analysis, Memory overflow underflow, Type matching, mismatching, global local variable. Intermediate Code Generation: Different Intermediate forms: three address code, Quadruples & Triples. Syntax Directed translation mechanism and attributed definition. Translation of Declaration, Assignment, Control flow, syntax tree, postfix translation.

Unit-V

Optimization and Code Generation: Local optimization, Loop optimization, Peephole optimization, Basic blocks and flow graphs, DAG, Data flow analyzer, Symbol Table management, Error handler.

Text Books:

1. Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education.
2. Alfred V Aho, Jeffrey D. Ullman, "Principles of Compiler Design", Narosa.

Reference Book(s):

1. Michal Sipser, "Theory of Computation", Cengage learning.
2. K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science : Automata, Languages and Computation", PHI.
3. Louden, "Compiler construction", Cengage learning.

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CS-6518: Cloud Computing

Aim:

To provide students with the fundamentals and essentials of Cloud Computing, thus creating a sound foundation while enabling students to start using and adopting Cloud Computing services and tools in their real-life scenarios.

Course Outcomes:

- CO 1: Learn the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
 - CO 2: Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
 - CO 3: To gain knowledge of virtualization and Hands-on exercises on AWS, Salesforce and Google Cloud.
 - CO 4: Understanding of appropriate cloud computing solutions and recommendations according to the applications.
 - CO 5: Learn the core issues and latest trends and technologies of cloud computing
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Unit-I

Introduction to cloud computing, History, Importance of cloud computing in the current era, characteristics of cloud computing, what cloud computing really is and isn't, pros and cons of cloud computing, technologies in cloud computing, migrating into cloud.

Unit-II

Types of clouds, cloud infrastructure, cloud application architecture, working of cloud computing, trends in cloud computing, cloud service models, cloud deployment models, cloud computing and services pros and cons.

Unit-III

Cloud computing technology, cloud life cycle model, role of cloud modeling and architecture, cloud system architecture, virtualization, types of virtualization, importance and limitations of various types of virtualization, virtualization in cloud computing.

Unit-IV

Data storage, introduction to enterprise data storage, data storage management, file system, cloud data stores, cloud storage characteristics, applications utilizing cloud storage.

Unit-V

Introduction to web services, cloud service deployment tools, management/ administrative services, risk management in cloud computing, introduction to apache Hadoop.

Text Books:

Cloud Computing: A practical approach for learning and implementation, 1st edition, Pearson, A. Srinivasan, J. Suresh.

Reference Book(s):

1. Investigating various tools such as VMWare, Eucalyptus etc.
2. Examining cloud applications in context to social networking, email, document/ spreadsheet hosting services etc. and various Google cloud applications.

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CS-5715: Artificial Intelligence and Machine Learning

Aim:

The learning objective of this course is to acquaint students with the theory and principles of Artificial Intelligence and Machine Learning and with representative practical systems

Course Outcomes:

- CO 1: Understand the basic concepts of artificial intelligence and machine learning
 - CO 2: Design and implement models based on supervised and unsupervised learning
 - CO 3: Evaluate and compare modelling aspects of various machine learning approaches
 - CO 4: Apply the ensemble methods for improving the learning algorithm
 - CO 5: Apply the concepts of neural networks and deep learning methods
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Unit-I

Introduction: Past, Present, and Future, Definition, Applications, Types of the learning system, Concept learning, Concept learning as search through a hypothesis space, General-to-specific ordering of hypotheses, finding maximally specific hypotheses, Version spaces, Inductive bias. Evaluation of Learning Algorithms: Measuring the accuracy of learned hypotheses, cross-validation, learning curves, Overfitting, Bias-Variance Trade off, Data Preprocessing, Feature Selection

Unit-II

Supervised Learning: Linear Regression, Gradient Descent (GD), Multiple Regression, Logistic Regression, k-Nearest Neighbor (k-NN) classifier.
Decision Tree Learning: Picking the best splitting attribute: entropy and information gain, ID3, C4.5, CART Algorithm, Decision tree classifier, Stopping Criterion & Pruning loss functions.

Unit-III

Dimensionality Problem: Dimensionality Problem, Feature Extraction, Principal Component Analysis (PCA)
Probabilistic Classifier: Probability and Bayes learning, Naïve Bayes classifier
Non-probabilistic Classifiers: Support Vector Machine (SVM) classifier

Unit-IV

Unsupervised Learning: Clustering, k-means clustering, Hierarchical clustering
Ensemble Methods: Ensemble Strategies, Boosting and Bagging, Random Forest, Ada-Boost algorithm

Unit-V

Artificial Neural Network: Introduction, Early Models, Multilayer Perceptron, Gradient Descent, Multiclass Representation, Backpropagation algorithm.
Deep Learning: Introduction, Convolutional Neural Networks (CNN), Recurrent Neural Networks
Recent Trends in Deep Learning: Generative Adversarial Networks (GAN), Large Language Model (LLM)

Text Books:

1. Tom M. Mitchell, "Machine Learning", Tata McGraw-Hill Education, 2017
2. Ethem Alpaydin, "Introduction to Machine Learning", PHI, Third Edition, 2015
3. Russell and Norvig, "Artificial Intelligence: A Modern Approach" 3rd Edition, 2010

Reference Book(s):

- NPTEL Course Video Lectures on "Introduction to Machine Learning" - By Prof. Sudeshna Sarkar, IIT Kharagpur
- Coursera Course Video Lectures on "Machine Learning" - By Prof. Andrew Ng, Stanford University
- Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", Oreily, Third Edition, 2022
- Andreas Muller and Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreily, 2016

CS-5615: Information Security

Aim:

The main aim of this course is to provide students a background, foundation and insight into the many dimensions of information security.

Course Outcomes:

- CO 1: Understand fundamental security concepts such as confidentiality, integrity, and availability.
 - CO 2: Identify and analyze various security threats and attacks.
 - CO 3: Apply symmetric and asymmetric cryptographic techniques for securing information.
 - CO 4: Implement access control mechanisms, digital signatures, and security protocols.
 - CO 5: Critically evaluate and apply security principles to real-world scenarios.
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Unit-I

Computer Security Concepts: Introduction to Information Security, Confidentiality, Integrity; Attacks and Threats: Attacks Threatening Confidentiality, Attacks Threatening Integrity, Attacks Threatening Availability; Active versus Passive attacks; Security Services, Security Mechanisms etc.

Unit-II

Symmetric Cipher Model: Cryptography, Cryptanalysis and Brute-Force Attack; Substitution Techniques: Caesar Cipher, Monoalphabetic Ciphers, Playfair Cipher, Hill Cipher; Polyalphabetic Ciphers, One-Time Pad; Transposition ciphers: keyless transposition ciphers, keyed transposition ciphers, combining two approaches; Steganography etc.

Unit-III

Stream Ciphers and Block Ciphers, Synchronous and Non-Synchronous Stream Ciphers, Attacks on Block Ciphers, Substitution and Transposition, P-Boxes and S-Boxes, Diffusion and Confusion, Feistel Cipher, DES Encryption and Decryption, Double and Triple DES, Strength and weakness of DES etc

Unit-IV

Advanced encryption standard (AES), General structure AES, strength and weakness of AES, Use of modern block cipher: Electronic Codebook (ECB) Mode, Cipher Block Chaining (CBC) Mode, Cipher Feedback (CFB) Mode, Output Feedback (OFB) Mode and Counter (CTR) Mode, Diffie-Hellman key exchange, Man in middle attack, (Ron Rivest) RC-5, Blowfish.

Unit-V

Asymmetric-Key cryptography algorithms: RSA Algorithm, Digital Signatures, Attacks on Digital Signatures, Public Key Infrastructure (PKI): Digital Certificates, Private -Key Management. Access Control and Authorization.

Text Books:

William Stallings, "Cryptography and Network Security: Principles and Practice", 6th Edition, Pearson/Prentice- Hall.

Reference Book(s):

1. Behrouz A. Forouzan "Introduction to Cryptography and Network Security", McGraw-Hill Higher Education, 2008
2. Atul Kahate; "Cryptography and Network Security"; Tata McGraw-Hill
3. Mathew Bishop; Computer Security; Art and Science; Addison-Wisley Oct. 2007
4. Kaufman, Perlman and Speciner; "Network security"; Pearson Education 1995.

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CS-5308: Information Technology Project Management

Aim:

Prepare students for a successful career in IT project management, enabling them to handle complex projects and lead teams effectively.

Course Outcomes:

- CO 1: Understanding the fundamental principles of project management, including planning, executing, monitoring, and controlling IT projects.
 - CO 2: Help the students to develop both technical skills (like software development and information systems) and managerial skills (such as risk management, budgeting, and team leadership).
 - CO 3: Learn to foster effective team dynamics and collaboration, which are crucial for the success of IT projects.
 - CO 4: Proficient in using various project management tools and software to track progress, manage resources, and ensure project goals are met.
 - CO 5: Enhance the ability to identify and solve problems systematically and creative.
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Unit-I

Introduction to Project Management: Project Attributes, Triple Constraints, Project Management, Skills for Project Managers. The Project Management and Information Technology Context: A Systems View of Project Management, The Three-Sphere Model for Systems Management, Understanding Organizations, Stakeholder Management, The Importance of Top Management Commitment, The Need for Organizational Commitment to Information Technology. The Project Management Process Groups: Project Management Process Groups, Mapping the Process Groups to the Knowledge Areas.

Unit-II

Project Integration Management: Project Integration Management, Developing a Project Charter, Developing a Project Management Plan, Directing and Managing Project Execution, Monitoring and Controlling Project Work, Performing Integrated Change Control, Closing Projects or Phases. Project Scope Management: Collecting Requirements, Defining Scope, Creating the Work Breakdown Structure, Verifying Scope, Controlling Scope.

Unit-III

Project Schedule Management: Planning, Defining and Sequencing Activities, Estimating Activity Durations, Developing the Schedule, Controlling the Schedule. Project Cost Management: Basic Principles of Cost Management, Planning Cost Management, Estimating Costs, Determining the Budget. Project Quality Management: Planning Quality Management, Managing Quality, Controlling Quality, Six Sigma, Improving IT Project Quality.

Unit-IV

Project Resource Management: Importance of Resource Management, Processes of Project Human Resource Management, Maslow's Hierarchy of Needs, Developing the Resource Management Plan and Team Charter, Estimating Activity Resources, Acquiring Resources, Developing and managing the

Project Team, General Advice on Managing Teams. Project Communications Management: Keys to Good Communications, Planning Communications Management, Managing Communications, Monitoring Communications, Running Effective Meetings.

Unit-V

Project Risk Management: Project Risk Management, Planning Risk Management, Common Sources of Risk on IT Projects, Identifying Risks, Planning Risk Responses, Monitoring Risks. Project Procurement Management: The Importance of Project Procurement Management, Planning Procurement Management, Statement of Work, Procurement Documents, Closing Procurements.

Text Books:

Schwalbe, Kathy. "Information technology project management". Cengage Learning,

Reference Book(s):

www.pmi.org (PMBOK)

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