ಮಂಗಳೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

MANGALORE UNIVERSITY

ಕ್ರಮಾಂಕ/ No. : MU/ACC/CR.7/2021-22/A8

ಕುಲಸಚಿವರ ಕಛೇರಿ

ಮಂಗಳಗಂಗೋತ್ರಿ – 574 199

Office of the Registrar

Mangalagangothri – 574 199

ದಿನಾಂಕ/Date: 04/08/2025

NOTIFICATION

Sub: Syllabus of V and VI Semester B.C.A(AI&ML) Degree Programme under NEP 2020 reg.

Ref: Approval of the Vice Chancellor Dtd: 02.08.2025 .

Pursuant to the above, the syllabus of V and VI Semester Bachelor of Computer Applications in Artificial Intelligence & Machine Learning {BCA(AI&ML)}Degree Programme under NEP 2020 is hereby notified for implementation with effect from the academic year 2025-26 Subject to the ratification of Academic Council.

Copy of the Syllabus shall be downloaded from the Mangalore University website www.mangaloreuniversity.ac.in .

(Draft approved by the Registrar)

FOR REGISTRAR

To:

1) The Registrar (Evaluation), Mangalore University,Mangalagangotri,Mangalagangotri.
2) The Principals of the colleges concerned.
3) Prof.H.L. Shashirekha, Chairperson, UG BOS in Computer Science and Computer Applications, P.G. Dept. of Computer Science, Mangalore University
4) The Assistant Registrar/The Superintendent, Academic Section,O/o theRegistrar, Mangalore University, Mangalagangotri.
5) Guard File.

MANGALORE UNIVERSITY

National Education Policy – 2020

[NEP-2020]

CURRICULUM STRUCTURE

FOR

BCA-ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(V and VI Semester)

July 2025

CURRICULUM STRUCTURE FOR V SEMESTER

Course Code	Theory/ Practical	Credits	Course Title	SA	IA
BCAAIMN501	Theory	4	Artificial Intelligence-2	60	40
BCAAIPN504	Practical	2	AI-2 Lab	25	25
BCAAIMN502	Theory	4	Machine Learning	60	40
BCAAIMP505	Practical	2	Machine Learning Lab	25	25
BCAAIMN503	Theory	4	Software verification and Validation	60	40
BCAAIEN501	Theory	3	Web Technologies	60	40
BCAAIVN502	Theory	3	Cyber Crime and Cyber Law	60	40
COMESSN501	Theory	3	Employability skills	60	40

CURRICULUM STRUCTURE FOR VI SEMESTER

Course No	Theory/ Practical	Credits	Course Title	SA	IA
BCAAIMN601	Theory	4	Neural Networks	60	40
BCAAIPN604	Practical	2	Neural Networks Lab	25	25
BCAAIMN602	Theory	4	.NET Technologies	60	40
BCAAIMP605	Practical	2	.NET Technologies Lab	25	25
BCAAIMN603	Theory	4	Natural Language Processing	60	40
BCAAIVN601	Theory	3	Digital Marketing	60	40
BCAAIEN601	Theory	3	Digital Image Processing	60	40
	Theory/ Practical	2	Mini Project	30	20

Program	BCA (AIML)	Semester	V
Course Title	**Artificial Intelligence-2**		
Course Code	BCAAIMN501	Credits	04
Contact Hours	52 Hrs	Duration of Exam	02 Hrs
Formative Assessment Marks	40 Marks	Summative Assessment Marks	60 Marks

Course Outcomes (COs):

CO1. Apply appropriate problem-solving strategies and search techniques to design intelligent agents that operate efficiently in deterministic and nondeterministic environments.

CO2. Analyze and implement probabilistic reasoning techniques including Bayesian networks and temporal models for decision-making under uncertainty.

CO3. Evaluate learning strategies including reinforcement learning and sequential decision-making methods to solve real-world decision problems.

CO4. Design machine learning models using supervised learning techniques such as decision trees, regression, and neural networks to make predictions and classifications.

CO5. Develop systems that integrate logic-based learning, explanation-based learning, and inductive logic programming for knowledge representation and inference.

CO6. Critically reflect on philosophical, ethical, and societal implications of developing and deploying Artificial Intelligence systems.

UNIT-1 [13 Hrs]
Problem-Solving Agent - Problem formulation, searching solution and executing actions. Measuring Problem-Solving Performance -Completeness, Optimality, Time complexity, Space complexity. **Beyond Classical Search:** Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions Searching with Partial Observations **Adversarial Search:** Games, Optimal Decisions in Games, Alpha–Beta Pruning, Imperfect Real-Time Decisions Stochastic Games
UNIT-2 [13 Hrs]
Uncertain Knowledge: Uncertainty - Quantifying uncertainty - Acting under uncertainty – basic probability notation – inference using full joint distributions – independence - Bayes' rule and its use. **Probabilistic Reasoning**: Representing knowledge in an uncertain domain – semantics of Bayesian networks – efficient representation of conditional distributions – exact and approximate inference in Bayesian networks - relational and first order probability models – Time and uncertainty – inference in temporal models Bayesian Learning: Learning with complete and hidden data – Expectation Maximization Algorithm; – Hidden Markov Models – Kalman filters – dynamic Bayesian networks – multiple object tracking.

UNIT-3 [13 Hrs]
Reinforcement Learning: Basics of Reinforcement learning – Active and Passive reinforcement learning – Generalization – Applications. **Making simple decisions**: combining beliefs and desires – The basis of utility theory – Utility functions – multi attribute utility functions – decision networks – The value of information – Decision theoretic expert systems; Sequential Decision problems – value iteration – policy iteration – Partially Observable MDPs **Decisions with Multiple Agents** : Game Theory – Mechanism Design.
UNIT-4 [13 Hrs]
Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees. Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Linear Models, Artificial Neural, Nonparametric Models, Support Vector Machines, Ensemble Learning **Knowledge in Learning**: A Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning using Relevance Information, Inductive Logic Programming. **Philosophical Foundations**: Weak AI: Can Machines Act Intelligently? Strong AI: Can Machines Really Think? The Ethics and Risks of Developing Artificial Intelligence.
Text Book: 1. Russell, S. & Norvig, P. (2021) Artificial Intelligence: A Modern Approach (4th ed.). Pearson **Reference Books** 1. Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning by James V Stone, Sebtel Press, 2019. 2. Artificial Intelligence by Example: Acquire advanced AI, machine learning, and deep learning design skills by Denis Rothman, 2nd Edition, 2020. 3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

Program	BCA (AIML)	Semester	V
Course Title	**Machine Learning**		
Course Code	BCAAIMN502	Credits	04
Contact Hours	52 Hrs	Duration of Exam	02 Hrs
Formative Assessment Marks	40 Marks	Summative Assessment Marks	60 Marks

Course Outcomes (COs):

CO1. Explain the fundamental concepts of Machine Learning, its need, types, challenges, and applications, and analyze the nature and structure of data for learning tasks.

CO2. Apply descriptive and multivariate statistical techniques and understand basic hypothesis testing, feature engineering, and dimensionality reduction methods for data preprocessing.

CO3. Describe different types of learning models and theories including computational learning theory, concept learning, and similarity-based learning techniques.

CO4. Develop regression models such as linear, polynomial, and logistic regression, and implement decision tree algorithms for classification and regression tasks.

CO5. Apply Bayesian classification techniques and different clustering methods to analyze and group data based on underlying patterns.

CO6. Understand the principles of reinforcement learning and apply Q-learning to solve decision-making problems in uncertain environments.

UNIT-1 [13 Hrs]
Introduction to Machine Learning: Need for Machine Learning, Machine Learning Explained, Machine, Learning in Relation to Other Fields, Types of Machine Learning, Challenges of Machine Learning, Machine, Learning Process, Machine Learning Application. **Understanding Data:** Introduction, Big Data Analytics and Types of Analytics, Big Data Analysis Framework, Descriptive Statistics, Univariate Data Analysis and Visualization, Bivariate Data and Multivariate Data.
UNIT-2 [13 Hrs]
Multivariate Statistics, Essential Mathematics for Multivariate Data, Overview of Hypothesis, Feature Engineering and Dimensionality Reduction Techniques. **Basics of Learning Theory:** Introduction to Learning and its Types, Introduction to Computation Learning Theory, Design of a Learning System, Introduction to Concept Learning, Induction Biases, Modelling in Machine Learning. **Similarity-based Learning:** Introduction to Similarity or Instance-based Learning, Nearest-Neighbor Learning, Weighted K-Nearest-Neighbor Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR).
UNIT-3 [13 Hrs]
Regression Analysis: Introduction to Regression, Introduction to Linearity, Correlation, and Causation, Introduction to Linear Regression, Validation of Regression Methods, Multiple Linear Regression, Polynomial Regression, Logistic Regression.

Models Based on Decision Trees: Introduction to Decision Tree, Decision Tree for Classification, Impurity Measures for Decision Tree Construction, Properties of Decision Tree Classifier (DTC), Applications in Breast Cancer Data, Regression Based on Decision Tress.

UNIT-4 [13 Hrs]

Bayesian Learning: Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Model.
Clustering: Introduction to Clustering, Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering.
Reinforcement Learning: Overview and Scope of Reinforcement Learning, Components of Reinforcement Learning, Q-Learning.

Textbooks

1. S Sridhar and M Vijayalakshmi, "Machine Learning", Oxford University Press, 2021.
2. M N Murty and Ananthanarayana V S, "Machine Learning: Theory and Practice", Universities Press (India) Pvt. Limited, 2024.

Reference Books:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education, 2013.
2. Miroslav Kubat, "An Introduction to Machine Learning", Springer, 2017.

Program	BCA (AIML)	Semester	V
Course Title	**Software Verification and Validation**		
Course Code	BCAAIMN503	Credits	04
Contact Hours	52 Hrs	Duration of Exam	02 Hrs
Formative Assessment Marks	40 Marks	Summative Assessment Marks	60 Marks

Course Outcomes (COs):

CO1. Explain the foundational concepts of software testing and analysis, including the role of verification and validation within a software process and the basic principles that guide quality assurance.
CO2. Apply various modeling techniques such as control flow graphs, data flow models, and finite state machines to represent and analyze software behavior and properties.
CO3. Design effective test cases using functional, structural, data flow, and model-based testing techniques, and evaluate their adequacy for different testing scenarios.
CO4. Analyze and implement testing strategies for object-oriented software, addressing unique challenges like inheritance, polymorphism, and dynamic binding.
CO5. Utilize fault-based testing techniques such as mutation testing and apply test execution concepts including scaffolding, test oracles, and capture-replay mechanisms.
CO6. Demonstrate the use of program analysis tools and techniques like symbolic execution, memory analysis, and behavior model extraction for validating software systems.

UNIT-1 [13 Hrs]
Fundamentals of Test and Analysis: Software Test and Analysis in a Nutshell; A Framework for Test and Analysis- Validation and Verification, Varieties of Software; Basic Principles-Sensitivity, Redundancy, Restriction, Partition, Visibility, Feedback; Test and Analysis Activities Within a Software Process - The Quality Process, Planning and Monitoring, Analysis, Testing, Improving the Process
UNIT-2 [13 Hrs]
Basic Techniques: Finite Models-Finite Abstractions of Behavior, Control Flow Graphs, Call Graphs, Finite State Machines; Dependence and Data Flow Models-Definition-Use Pairs, Data Flow Analysis, Classic Analyses: Live and Avail, From Execution to Conservative Flow Analysis; Symbolic Execution and Proof of Properties-Symbolic State and Interpretation, Loops and Assertions, Compositional Reasoning, Reasoning about Data Structures and Classes, Finite State Verification-State Space Exploration, The State Space Explosion Problem, The Model Correspondence Problem, Granularity of Modeling, Intensional Models, Model Refinement, Data Model Verification with Relational Algebra.
UNIT-3 [13 Hrs]
Problems and Methods: Test Case Selection and Adequacy-Test Specifications and Cases, Functional Testing-Random versus Partition Testing Strategies; Combinatorial Testing-Category-Partition Testing, Pairwise Combination Testing, Catalog-Based Testing, Structural

Testing-Statement Testing, Branch Testing, Condition Testing, Path Testing, Procedure Call Testing, Data Flow Testing-Definition-Use Associations, Data Flow Testing Criteria, Data Flow Coverage with Complex Structures; Model-Based Testing-Deriving Test Cases from Finite State Machines, Testing Decision Structures, Deriving Test Cases from Control and Data Flow Graphs, Deriving Test Cases from Grammars;

UNIT-4 [13 Hrs]

Testing Object-Oriented Software- Issues in Testing Object-Oriented Software, An Orthogonal Approach to Test, Intraclass Testing, Testing with State Machine Models, Interclass Testing, Structural Testing of Classes, Oracles for Classes , Polymorphism and Dynamic Binding, Inheritance, Genericity, Exceptions; Fault-Based Testing- Mutation Analysis, Fault-Based Adequacy Criteria, Variations on **Mutation Analysis**; Test Execution-From Test Case Specifications to Test Cases, Scaffolding, Generic versus Specific Scaffolding, Test Oracles, Self-Checks as Oracles, Capture and Replay; Program Analysis-Symbolic Execution in Program Analysis, Symbolic Testing, Memory Analysis, Lockset Analysis, Extracting Behavior Models from Execution

Text Book

1. Software Testing and Analysis: Process, Principles, and Techniques, Mauro Pezz`e & Michal Young, Wiley, 2008

Reference Books

2. Pressman, R. S., & Maxim, B. R. (2020). *Software engineering: A practitioner's approach* (9th ed.). McGraw-Hill Education.
3. Burnstein, I. (2003). *Practical software testing: A process-oriented approach*. Springer.
4. Myers, G. J., Sandler, C., & Badgett, T. (2011). *The art of software testing* (3rd ed.). John Wiley & Sons.
5. Beizer, B. (1995). *Black-box testing: Techniques for functional testing of software and systems*. John Wiley & Sons.
6. Jorgensen, P. C. (2013). *Software testing: A craftsman's approach* (4th ed.). CRC Press.
7. Ammann, P., & Offutt, J. (2016). *Introduction to software testing* (2nd ed.). Cambridge University Press.

Program	BCA (AIML)	Semester	V
Course Title	**Web Technologies**		
Course Code	BCAAIEN501	Credits	03
Contact Hours	42 Hrs	Duration of Exam	02 Hrs
Formative Assessment Marks	40 Marks	Summative Assessment Marks	60 Marks

Course Outcomes (COs):

CO1. Describe the architecture and foundational technologies of the web, including web protocols, web servers, client-server technologies, and HTML5 structure for creating well-designed web pages.

CO2. Apply HTML5 elements and multimedia tags to build interactive and semantically rich web pages, incorporating layout, navigation, forms, and embedded media.

CO3. Develop well-styled web interfaces using XML and CSS, applying styles, positioning, box modeling, gradients, transitions, and basic animations to enhance user experience.

CO4. Write and debug JavaScript programs using data types, control structures, functions, events, and objects, and manipulate the Document Object Model (DOM) to create dynamic web content.

CO5. Implement server-side web functionality using Servlets, manage HTTP requests and responses, sessions, and database interactions using JDBC.

CO6. Identify common web vulnerabilities such as SQL Injection, XSS, and Authentication flaws, and apply preventive measures to enhance web application security.

Unit-1 [11 Hrs]
Introduction and Web Design: Introduction to Internet, WWW and Web 2.0, Web browsers, Web protocols and Web servers, Web DesignPrinciples and Web site structure, client-server technologies, Client sidetools and technologies, Server-side Scripting, URL, MIME, search engine, web server- Apache, IIS, proxy server, HTTP protocol. Introductions to HTML. HTML5 Basics tags, Formatting tags in HTML, HTML5 Page layout and Navigation concepts, Semantic Elements in HTML, List, type of list tags, tables and form tags in HTML, multimediabasics, images, iframe, map tag, embedding audio and video clips on webpage.
Unit-2 [10 Hrs]
Introduction to XML: XML Syntax, XML Tree, Elements, Attributes, Namespace, Parser, XSLT DOM, DTD, Schema. Introduction to CSS, CSS syntax, CSS selectors, CSS Background Cursor, CSS text fonts, CSS-List Tables, CSS Box Modeling, Display Positioning, Floats, CSS Gradients, Shadows, 2D and 3 Transform, Transitions, CSS Animations.
Unit-3 [10 Hrs]
Introduction to JavaScript: JavaScript Data type and Variables, JavaScript Operators, Conditional Statements, Looping Statements, JavaScript Functions, Number, Strings, Arrays, Objects in JavaScript, Window and Frame objects, Event Handling in JavaScript, Exception Handling, Form Object and DOM, JSON, Browser Object Model.

Unit-4 [11 Hrs]
Introduction to Servlets: Common Gateway Interface (CGI), Lifecycle of a Servlets, deploying a Servlets, The Servlets API, Reading Servlets parameters, reading initialization parameters, Handling HTTP Request & Responses, Using Cookies and sessions, connecting to a database using JDBC. **Web Security:** Authentication Techniques, Design Flaws in Authentication, Implementation Flaws in Authentication, Securing Authentication, Path Traversal Attacks. Injecting into Interpreted Contexts, SQL Injection, NoSQL Injection, XPath Injection, LDAP Injection, XML Injection, HTTP Injection, Mail Service Injection. Types of XSS, XSS in Real World, Finding and Exploiting XSS Vulnerabilities, Preventing XSS Attacks.

Text Books:

1. Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dremtech
2. Java Server Pages – Hans Bergsten, SPD O'Reilly
3. Java Script, D. Flanagan, O'Reilly, SPD
4. Beginning Web Programming-Jon Duckett WROX.
5. Internet and World Wide Web – How to program, Dietel and Nieto, Pearson

Reference Books:

1. Web Applications: Concepts and Real-World Design, Knuckles, Wiley-India

Program	BCA (AIML)	Semester	V
Course Title	**Cyber Crime and Cyber Law**		
Course Code	BCAAIVN502	Credits	03
Contact Hours	42 Hrs	Duration of Exam	02 Hrs
Formative Assessment Marks	40 Marks	Summative Assessment Marks	60 Marks

Course Outcomes (COs):

CO1: After completion of this course, students would be able to understand the concept of Cyber security and issues and challenges associated with it.

CO2: Students, at the end of this course, should be able to understand the cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.

CO3: On completion of this course, students should be able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.

CO4: After the completion of this module, students would be able to understand the basic concepts related to E-Commerce and digital payments. They will become familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds.

UNIT-1 [11 Hrs]
Introduction to Cyber Security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Internet infrastructure for data transfer and governance, Genesis of cyber law - Growth and development of cyber law in India - Significance and objectives of cyber law. The difference between Real Space and Cyber Space - Conceptual and theoretical perspective of Cyber Law - Cyber sovereignty - Various components of cyber law - Data and privacy - Cybercrimes - Intellectual property - Electronic and digital signatures. Categories of cybercrimes - Cybercrimes against Individual - Cybercrimes against Property - Cybercrimes against Government
UNIT-2 [11 Hrs]
Cyber Crime and Cyber Law: Classification of cybercrimes, Common cybercrimes-cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organisations dealing with Cybercrime and Cyber security in India.
UNIT-3 [10 Hrs]
Social Media Overview and Security: Introduction to Social networks. Types of social media, social media platforms, social media monitoring, Hashtag, Viral content, social media marketing, social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, best practices for the use of social media.
UNIT-4 [10 Hrs]
E-Commerce and Digital Payments: Definition of E-Commerce, Main components of ECommerce, Elements of E-Commerce security, ECommerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-

Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act, 2007.

Reference Books

1. R. C Mishra, (2010) Cyber Crime: Impact on the New Millennium, Authors Press. Edition 2010.
2. Sunit Belapure and Nina Godbole, (2011). Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India Pvt. Ltd., First Edition.
3. Henry A. Oliver, (2015) Security in the Digital Age: Social Media Security Threats and Vulnerabilities, Create Space Independent Publishing Platform, Pearson.
4. Elias M. Awad, (2001) Electronic Commerce, Prentice Hall of India Pvt Ltd.
5. Krishna Kumar, (2011) Cyber Laws: Intellectual Property & E-Commerce Security, Dominant Publishers.
6. Eric Cole, Ronald Krutz, (2011) Network Security Bible, Wiley India Pvt. Ltd, 2nd Edition.
7. E. Maiwald , (2017) Fundamentals of Network Security, McGraw Hill.

Program	BCA (AIML)	Semester	V
Course Title	**AI-2 Lab**		
Course Code	BCAAIPN504	Credits	02
Contact Hours	52 Hrs	Duration of Exam	03 Hrs
Formative Assessment Marks	25 Marks	Summative Assessment Marks	25 Marks

Program	BCA (AIML)	Semester	V
Course Title	**Machine Learning Lab**		
Course Code	BCAAIPN505	Credits	02
Contact Hours	52 Hrs	Duration of Exam	03 Hrs
Formative Assessment Marks	25 Marks	Summative Assessment Marks	25 Marks

Program	BCA (AIML)	Semester	VI
Course Title	**Neural Networks**		
Course Code	BCAAIMN601	Credits	04
Contact Hours	52 Hrs	Duration of Exam	02 Hrs
Formative Assessment Marks	40 Marks	Summative Assessment Marks	60 Marks

COURSE OUTCOMES (COs):

CO1: Understand the fundamentals such as neural networks, learning process and their applications.

CO2: Understand Single Layer Perceptrons and also explain and contrast back-propagation networks to single-layer perceptrons

CO3. Understand how to train Back propagation algorithm and setting the parameter values.

CO4: Understand fundamental concepts of neuro dynamics, including dynamical systems, stability of equilibrium states, and attractors, in the context of recurrent neural networks.

UNIT-1 [13 Hrs]
Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process
UNIT-2 [13 Hrs]
Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection
UNIT-3 [13 Hrs]
Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning. Attractor Neural Networks: Associative Learning Attractor Associative Memory, Linear Association Memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory.
UNIT-4 [13 Hrs]
Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm Hopfield Models – Hopfield Models, Computer Experiment
Text Books: 1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.

Reference Books:

1. Artificial Neural Networks - B. Vegnanarayana Prentice Hall of India P Ltd 2005
2. Neural Networks in Computer Inteligance, Li Min Fu MC GRAW HILL EDUCATION 2003
3. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004. 4. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006. Neural Networks A Classroom Approach, Satish Kumar, McGraw Hill Eduation (India) Pvt. Ltd., IInd Editions
4. Introduction to Artificial Neural Systems, J.M. Zurada, Jaico Publications, 1994
5. Artificial Neural Networks, B Yegnanarayana, PHI, 1998

Program	BCA (AIML)	Semester	VI
Course Title	**.NET Technologies**		
Course Code	BCAAIMN602	Credits	04
Contact Hours	52 Hrs	Duration of Exam	02 Hrs
Formative Assessment Marks	40 Marks	Summative Assessment Marks	60 Marks

Course Outcomes (COs):

CO1. Understand the fundamental concepts of C#, its features, evolution, and the .NET framework, and explain how C# differs from other languages like Java.

CO2. Apply core programming constructs of C# such as data types, variables, methods, command-line arguments, and namespaces to write structured programs.

CO3. Develop object-oriented programs using classes, objects, constructors, destructors, method overloading, inheritance, and interfaces to solve real-world problems.

CO4. Design interactive web applications using ASP.NET Web Forms and effectively utilize standard and validation controls.

CO5. Integrate ADO.NET with ASP.NET applications to perform data access operations and bind data to web controls using both simple and complex binding techniques.

CO6. Demonstrate the ability to build dynamic web applications in C# by leveraging the .NET environment, Visual Studio, and web control libraries.

UNIT-1 [13 Hrs]
Introducing C#: What is C#, Why C#, Evolution of C#, Characteristics of C#, Applications of C#, How does C# differ from Java **Understanding the .NET Environment**: The ,NET Strategy, The Origins of .NET Technology, The .NET Framework, The Common Language Runtime, Visual Studio .NET, .NET Languages, Benefits of .NET Approach, C# and the .NET **Overview of C#:** Introduction, Simple C# Program, Namespaces, Adding Comments, Command Line Arguments **Literals, Variables and Data Types**: Data Types, Scope of variables, Boxing and Unboxing **Methods in C#:** Declaring Methods, The Main Method, Invoking Methods, Nesting of Methods, Method Parameters, Pass by Value, Pass by Reference, Output Parameters, Variable Argument Lists
UNIT-2 [13 Hrs]
Classes and Objects: Introduction, Basic Principles of OOP, Defining a Class, Adding Variables, Adding Methods, Member Access Modifiers, Creating Objects, Accessing Class Members, Constructors, Overloaded Constructors, Static Members, Static Constructors, Private Constructors, Copy Constructors, Destructors, Member Initialization, The this Reference, Nesting of Classes, Constant Members, Read-only Members **Inheritances and Polymorphism**: Introduction, Classical Inheritance, Containment Inheritance, Defining Subclasses, Visibility Control, Defining Subclasss Constructors, Multilevel Inheritance, Hierarchical Inheritance, Overriding Methods, Hiding Methods, Abstract Classes, Abstract Methods, Sealed Classes, Sealed Methods **Interface: Multiple Inheritance**: Introduction, Defining an Interface, Extending an Interface, Interfaces and Inheritance
UNIT-3 [13 Hrs]
Introduction to ASP .NET: ASP .NET Definition, Features of ASP .NET, Characteristics of ASP .NET web Forms, Types of ASP .NET Web Server Controls **ASP .NET Standard Controls** – TextBox, Button, Label, Image, ImageButton, DropDownList, CheckBox, CheckBoxList, RadioButton, RadioButtonList, Panel, AdRotator, Calender, HyperLink Controls. **Validation Controls** – BaseValidator Class, RequiredField Validator, RangeValidator, CompareValidator, RegularExpression Validator, Validation Summary Control. **ADO .NET** – ADO .NET objects, DataSource Controls, DataBound Controls

UNIT-4 [13 Hrs]

Data Access Connectivity: ADO.NET: Introduction to ADO.NET, ADO vs ADO.NET Architecture: Data reader, Data adopter, Accessing Data with ADO.NET. Binding Controls to Databases: Various ways to bind the data, simple binding, complex binding, binding data to control. Programming Web Applications with Web Forms. Web Controls in C#, ASP.NET applications with ADO.NET.

Text Books

1. Balagurusamy, E. (2010). Programming in C#: A primer (3rd ed.). New Delhi: Tata McGraw-Hill Publishing Company Ltd.
2. Crouch, M. J. (2012). ASP.NET and VB.NET web programming. Packt Publishing.

References:

1. ASP .NET 4.5 – Black Book, DreamTech Press
2. Visual Basic.NET, Shirish Chavan, 3rd Edition, Pearson Education, 2009.
3. ASP.NET and VB.NET Web Programming, Matt J. Crouch, Edition 2012.
4. Computing with C# and the .NET Framework, Arthur Gittleman, 2nd Edition, Jones & Bartlett Publishers, 2011
5. ASP .NET 4.0 in simple steps, Kogent publications
6. Bill Evjen, Scott Hanselman, Devin Rader, Professional ASP .NET 4 with C# and VB

Program	BCA (AIML)	Semester	VI
Course Title	**Natural Language Processing**		
Course Code	BCAAIMN603	Credits	04
Contact Hours	52 Hrs	Duration of Exam	02 Hrs
Formative Assessment Marks	40 Marks	Summative Assessment Marks	60 Marks

Course Outcomes (COs):

CO1. Understand natural language processing and to learn how to apply basic algorithms in this field.
CO2. Understand POS tagging and context free grammar for English language
CO3. Learn how model linguistic phenomena with formal grammars; and to design, implement and test algorithms for NLP problems
CO4. Understand the mathematical and linguistic foundations underlying approaches to the various areas in NLP
CO5. Apply NLP techniques to design real world NLP applications such as machine translation, text categorization, text summarization, information extraction

UNIT-1
Introduction: History of NLP, Generic NLP system, levels of NLP, Knowledge in language processing, Ambiguity in Natural language, stages in NLP, challenges of NLP, Applications of NLP**.** Evaluation of NLP System. Speech Processing, **Word Level Analysis**: Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite state transducers (FST), Morphological parsing with FST, Lexicon free FST Porter stemmer.
UNIT-2
Syntax Analysis: Part-Of-Speech tagging (POS)- Tag set for English (Penn Treebank) , Rule based POS tagging, Stochastic POS tagging, Issues –Multiple tags & words, Unknown words. Introduction to CFG, Sequence labeling: Hidden Markov Model (HMM), Maximum Entropy, and Conditional Random Field (CRF). **Parsing Techniques & Grammar:** Parsing Process, Algorithm, Efficient Parsing, Types of Parsing Techniques, Transition networks, Human Parsing, Feature Grammar, Parsing with Unification constraints, Parsing Integration and Unification
UNIT-3
Semantic Analysis: Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses – Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, Robust Word Sense Disambiguation (WSD) Dictionary based approach Syntax Driven Semantic Analysis Approach.
UNIT-4
Knowledge Representation for NLP: Human Language Technology, Information Discovery, issues in Semantic Representation. **Natural Language Generation**: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. **Machine Translation:** Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages
Text Books: 1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing", 2end Ed, 2014, Pearson Education.

2. James Allen, “Natural Language Understanding”, 2nd edition. Bejamin Cummings publishing.

Reference Books:

1. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press.
2. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, 2016, Create Space Independent Publishing Platform.
3. Jacob Eisenstein, Introduction to Natural Language Processing, 2019, MIT Press
4. Carol Genetti, How Languages Work: An Introduction to Language and Linguistics, 2019, Cambridge University Press.

Program	BCA (AIML)	Semester	VI
Course Title	**Digital Marketing**		
Course Code	BCAAIVN601	Credits	03
Contact Hours	42 Hrs	Duration of Exam	02 Hrs
Formative Assessment Marks	40 Marks	Summative Assessment Marks	60 Marks

Course Outcomes (COs):

CO1. Understand the fundamental concepts and principles of digital marketing.
CO2. Develop practical skills to implement various digital marketing strategies and techniques
CO3. Analyze and evaluate the effectiveness of digital marketing campaigns.
CO4. Apply critical thinking and problem-solving skills to real-world digital marketing scenarios.
CO5. Create comprehensive digital marketing plans and strategies.

UNIT-1 [11 Hrs]
Introduction to Digital Marketing: Overview of digital marketing, Evolution of digital marketing, Importance and benefits of digital marketing, Digital marketing channels and platforms Digital Marketing Strategy and Planning: Developing a digital marketing strategy, Setting goals and objectives, Budgeting and resource allocation. Campaign planning and execution, Monitoring and adjusting digital marketing campaigns.
UNIT-2 [10 Hrs]
Social Media Marketing: Overview of social media marketing, social media platforms and their features, Creating and optimizing social media profiles, social media content strategy, social media advertising and analytics.
UNIT-3 [10 Hrs]
Email Marketing: Introduction to email marketing, building an email list, creating effective email campaigns, Email automation and segmentation, Email marketing metrics and analytics Content Marketing: Understanding content marketing, Content strategy and planning, Content creation and distribution, Content promotion and amplification, Content marketing metrics and analytics.
UNIT-4 [11 Hrs]
Mobile Marketing: Mobile marketing overview, Mobile advertising strategies, Mobile app marketing, Location-based marketing, Mobile marketing analytics **Analytics and Reporting:** Importance of analytics in digital marketing, setting up web analytics tools (e.g., Google Analytics), Tracking and measuring key performance indicators (KPIs), Conversion tracking and optimization, Reporting and data visualization
Text Books: 1. Digital Marketing Strategy: An Integrated Approach to Online Marketing by Simon Kingsnorth. **References**

2. Email Marketing Rules: How to Wear a White Hat, Shoot Straight, and Win Hearts by Chad S. White
3. Content Inc.: How Entrepreneurs Use Content to Build Massive Audiences and Create Radically Successful Businesses by Joe Pulizzi
4. Mobile Marketing: How Mobile Technology is Revolutionizing Marketing, Communications and Advertising by Daniel Rowles
5. Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity by Avinash Kaushik

Program	BCA (AIML)	Semester	VI
Course Title	**Digital Image Processing**		
Course Code	BCAAIEN601	Credits	03
Contact Hours	42 Hrs	Duration of Exam	02 Hrs
Formative Assessment Marks	40 Marks	Summative Assessment Marks	60 Marks

Course Outcomes (COs):

CO1. Understand image formation, role of human visual system plays in perception of gray and color image data.

CO2. Apply image processing techniques in both the spatial and frequency (Fourier) domains. Apply different de-noising models to recover original image.

CO3. Design image analysis techniques, image segmentation and to evaluate the Methodologies for segmentation. Conduct independent study and analysis of feature extraction techniques.

CO4. Identify different pattern recognition techniques and apply them in real world problems.

CO5. Learn how to classify patterns. And build a statistical classifier and will learn how to use other classifiers.

UNIT-1 [10 Hrs]
Digital Image Processing: Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. **Digital Image Fundamentals**: Elements of Visual Perception, A Simple Image Formation Model, Sampling and Quantization, Representing Digital Images, Spatial and Gray-level Resolution, Zooming and Shrinking, Basic Relationships Between Pixels, Linear and Nonlinear Operations.
UNIT-2 [10 Hrs]
Image Enhancement in the Spatial Domain: Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Combining Spatial Enhancement Methods. **Image Enhancement in the Frequency Domain**: Introduction to the Fourier Transform and the Frequency Domain, Frequency-Domain Filters, Homomorphic Filtering.
UNIT-3 [11 Hrs]
Image Restoration: Image degradation/Restoration process, Noise Models, Restoration in, Periodic Noise Reduction, Degradations, Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Least Square Filtering, Geometric Mean Filter. **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation. **Image Feature Extraction:** Image Features and Extraction–Image Features– Types of Features–Feature Extraction–SIFT, SURF and Texture–Feature Reduction Algorithms
UNIT-4 [11 Hrs]
Image Representation: Representation, Boundary Descriptors, Regional Descriptors. **Introduction to Pattern Recognition:** Elements of Image Analysis, Introduction to pattern classification, Feature selection and extraction, Supervised and Unsupervised Parameter estimation.

Basic concepts- Structure of a typical pattern recognition system, Feature vector, Feature spaces, Pattern classification by distance functions - Minimum distance classification. Application of pattern recognition.

Text Books:

1. Rafael C Gonzalez and Richard E. Woods: "Digital Image Processing", 4th Edition, 2018, Pearson Publication.
2. Sergios Theodoridis, Konstantinos Koutroumbas, "Pattern Recognition", 5th Edition, 2018, Academic Press.

Reference Books:

1. Scott. E. Umbaugh, Digital Image Processing and Analysis, 3rd Edition, 2017, CRC Press
2. M. Sonka Milan, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis and Machine Vision, 4th Edition, 2014, Cengage Learning
3. Rafael C. Gonzalez, Richard Eugene Woods, Digital Image Processing Using MATLAB, 2nd Edition, 2013. Tata McGraw Hill Ed.
4. Chris Solomon, Toby Breckon, Fundamentals of Digital Image Processing: A Practical Approach with Examples.
5. W. K. Pratt, Introduction to Digital Image Processing, 2014, CRC Press.
6. Richard O. Duda, Peter E. Hart, David G. Stork, Pattern Classification, 2nd Ed, 2012, John Wiley & sons
7. Christopher M. Bishop, Pattern Recognition and Machine Learning, 2016, Springer.

Program	BCA (AIML)	Semester	VI
Course Title	Neural Networks Lab		
Course Code	BCAAIPN604	Credits	02
Contact Hours	52 Hrs	Duration of Exam	03 Hrs
Formative Assessment Marks	25 Marks	Summative Assessment Marks	25 Marks

Program	BCA (AIML)	Semester	VI
Course Title	**.NET Technology Lab**		
Course Code	BCAAIMP605	Credits	02
Contact Hours	52 Hrs	Duration of Exam	03 Hrs
Formative Assessment Marks	25 Marks	Summative Assessment Marks	25 Marks