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BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE New Delhi)

Yelahanka, Bengaluru 560119

Bachelor of Engineering

Department of Artificial Intelligence & Machine Learning

V Semester Scheme & Syllabus 2022
Effective from the AY 2025-26

Vision and Mission of the Department

Vision

To emerge as a leading department in AI and ML by preparing skilled, responsible, and eco-friendly professionals who use technology to improve society.

Mission

M1. To equip students with in-depth knowledge in Artificial Intelligence and Machine Learning, built upon a robust foundation in Computer Science and Engineering through industry focused curriculum with practical learning.

M2. To encourage research and innovation through industry partnerships and sustainable technology practices.

M3. To inspire students toward ethical leadership and entrepreneurship through innovative and collaborative student-led activities.

Program Educational Objectives (PEOs)

PEOs	
PEO1	Graduates will thrive as IT professionals, applying AI and ML to build creative and lasting solutions.
PEO2	Graduates will pursue further studies, research, and entrepreneurship, keeping up with technological advancements in various fields.
PEO3	Graduates will demonstrate ethics, integrity, leadership, teamwork, and a dedication to continuous learning in their careers

Program Specific Outcomes (PSOs)

PSOs	
PSO-1	Apply foundational knowledge of Computer Science along with AI and ML techniques to design effective, real-world solutions across diverse application domains.
PSO-2	Develop AI-driven innovations with a commitment to ethics, social responsibility, and sustainability

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institution Affiliated to VTU, Belagavi)

B. E. in Artificial Intelligence & Machine Learning

Scheme of Teaching and Examinations – 2022 Scheme

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2025-26 onwards)

V Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Credits Distribution				Examination				Contact Hours/week
					L	T	P	Total	CIE Marks	SEE Marks	Total Marks	SEE Duration (H)	
1	HSMC	BCS501	**Software Engineering & Project Management**	TD: AI & ML PSB: AI & ML	3	0	0	3	50	50	100	3	3
2	IPCC	BAI502	**Data Communication and Networking**		3	0	1	4	50	50	100	3	3 + 2 = 5
3	PCC	BAI503	**Machine Learning**		4	0	0	4	50	50	100	3	4
4	PCCL	BAIL504	**Machine Learning Lab**		0	0	1	1	50	50	100	3	2
5	PEC	BAI505X	**Professional Elective Course I**		3	0	0	3	50	50	100	3	3
6	PW	BAI506	**Mini Project**		0	0	3	3	50	50	100	3	6
7	AEC	BRMK507	**Research Methodology and IPR**	Any Department	2	0	0	2	50	50	100	3	2
8	MC	BESK508	**Environmental Studies**	TD: CV PSB: CV	1	0	0	1	50	50	100	1	1
9	NCMC	BNSK509	**National Service Scheme (NSS)**	NSS Coordinator	0	0	0	0	100	-	100	-	2
		BPEK509	**Physical Education (Sports and Athletics)**	PED									
		BYOK509	**Yoga**	Yoga Teacher									
		BNCK509	**National Cadet Corps (NCC)**	NCC officer									
		BMUK509	**Music**	Music Teacher									
TOTAL					**16**	**00**	**05**	**21**	**500**	**400**	**900**	**-**	**28**

HSMC: Humanities, Social Sciences and Management Course, **IPCC**: Integrated Professional Core Course, **PCC**: Professional Core Courses, **PCCL**: Professional Core Course laboratory, **PEC:** Professional Elective Course, **PW:** Project Work, **AEC**: Ability Enhancement Course, **MC:** Mandatory Course, **NCMC**: Non Credit Mandatory Course, **L:** Lecture, **T**: Tutorial, **P**:

Practical, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course I

Course Code	Course Name	Course Code	Course Name
BAI505A	Blockchain Technology	BAI505C	Applications of Artificial Intelligence
BAI505B	Computer Vision	BAI505D	Data Integration and Warehousing

Integrated Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical's of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga/NCC/Music: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), Yoga (YOG), National Cadet Corps (NCC) and Music with the concerned coordinator of the course during the beginning of each semester starting from III semester to VII semester. In every semester, students should choose any one mandatory course among the available 5 courses without repeating the course again. Activities shall be carried out in each of the semesters from III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Mini Project: The Mini Project Work is a part of the curriculum in the pre-final year. Mini Project is a course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. Based on the ability/abilities of the student/s and recommendations of the mentor, a Mini- project can be assigned to a group having not more than 4 students. A comprehensive report is to be prepared after completion of the project work.

Syllabus of V Semester

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
Choice Based Credit System (CBCS)
SEMESTER – V

Software Engineering and Project Management (3:0:0:0) 3
(Effective from the academic year 2025-26)

Course Code	BCS501	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

- Outline software engineering principles and processes involved in building software by following professional and ethical laws.
- To gain knowledge of the development of software projects by applying phases of SDLC
- Outline the various levels of software evaluation and software evolution to meet the changes.
- Identify software quality parameters, and schedule of project activities.

Preamble: In today's digital age, software engineering is an essential component of technological innovation and societal growth. As the world becomes more reliant on complex software systems to power business, education, healthcare, entertainment, and everyday life, the demand for experienced software engineers grows. This field applies ideas from computer science, engineering, and project management to create, maintain, and upgrade software systems that are dependable, efficient, and user-friendly.

Learning software engineering provides students with a solid foundation in software development processes, system design, and project management. It promotes critical thinking, problem-solving skills, and the capacity to adapt to fast changing technology. Students learn how to create software that satisfies user requirements, adheres to quality standards, and survives the test of time.

As future software engineers, students embark on a journey of continual learning and creativity, ready to contribute to technological growth and societal improvement.

Module – I

Introduction: Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies.

Software Processes: Models: Waterfall Model, Incremental Model, and Spiral Model. Process activities. 0

Requirements Engineering: Requirements Engineering Processes. Requirements Elicitation and Analysis. Functional and non-functional requirements. The Software Requirements Document. Requirements Specification. Requirements validation. Requirements Management.

Textbook 1: Chapter 2 (Sections 2.1.1 – 2.1.3)
Textbook 1: Chapter 4 (Sections 4.1,4.2,4.3,4.5,4.6,4.7) (08 Hours)

Module – II

System Models: Context models (Sec 5.1). Interaction models (Sec 5.2). Structural models (Sec 5.3). Behavioral models (Sec 5.4). Model-driven engineering (Sec 5.5). Design and Implementation: Introduction to RUP (Sec 2.4), Design Principles (Chap 7). Object-oriented design using the UML (Sec 7.1). Design patterns (Sec 7.2). Implementation issues (Sec 7.3). Open-source development (Sec 7.4).

Textbook 1: Chapter 5 (Sections 5.1 to 5.5)
Textbook 1: Chapter 7 (Sections 7.1 to 7.4) (08 Hours)

Module – III

Software Testing: Development testing, Test-driven development, Release testing, and User testing. Test Automation.
Software Evolution: Evolution processes. Program evolution dynamics. Software maintenance. Legacy system management.
Textbook 1: Chapter 8 (Sections 8.1 to 8.4)
Textbook 1: Chapter 9 (Sections 9.1 to 9.4) (08 Hours)

Module – IV

Project Planning: Software pricing. Plan-driven development. Project scheduling: Estimation techniques. Quality management: Software quality. Reviews and inspections. Software measurement and metrics. Software standards

Textbook 1: Chapter 23 (Sections 23.1 to 23.5)
Textbook 1: Chapter 24 (Sections 24.1 to 24.4) (08 Hours)

Module – V

Introduction to Software Project Management and Project Evaluation: Importance of Software Project Management, Activities, Methodologies, Categorization of Software Projects, Setting objectives, Management Principles, Management Control, Project portfolio Management, Cost-benefit evaluation technology, Risk evaluation.
Textbook 2: Chapters 1 and 2 (08 Hours)

Course outcomes:
At the end of the course, the student will be able to:
CO1: Understand the principles of the software engineering process and its phases.
CO2: Outline the nature of software systems based on process and system models.
CO3: Explain the software testing and evolution processes.
CO4: Demonstrate project planning process and quality management.
CO5: Understand the Project Management and its Activities.

Textbooks

1. Ian Sommerville: **Software Engineering**, 9th Edition, Pearson Education, 2017.
2. Bob Hughes, Mike Cotterell and Rajib Mall: **Software Project Management**, 6th Edition, Tata McGraw Hill, New Delhi, 2018.

Reference Books

1. Roger S. Pressman: Software Engineering-A Practitioner approach, 7th Edition, Tata McGraw Hill.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India

Alternate Assessment Tools (AATs) suggested:

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

Web links / e – resources:

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. http://elearning.vtu.ac.in/econtent/CSE.php
3. http://elearning.vtu.ac.in/econtent/courses/video/CSE/15CS42.html

DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING
Choice Based Credit System (CBCS)
SEMESTER – V

Data Communication and Networking (3:0:0:0) 3
(Effective from the academic year 2025-26)

Course Code	BAI502	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:1:0	SEE Marks	50
Total Number of Contact Hours	40(T) + 12(P)	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

- Comprehend the transmission technique of digital data between two or more computers and a computer network that allows computers to exchange data.
- Explain with the basics of data communication and various types of computer networks.
- Demonstrate Medium Access Control protocols for reliable and noisy channels.
- Expose wireless and wired LANs.

Preamble: Communication is defined as a process in which more than one computer transfers information, instructions to each other and for sharing resources. Computer networking refers to interconnected computing devices that can exchange data and share resources with each other. These networked devices use a system of rules, called communications protocols, to transmit information over physical or wireless technologies.

Module – I

Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, Introduction to Physical Layer-1: Data and Signals, Digital Signals, Transmission Impairment,

Textbook 1: Chapter 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6 (08 Hours)

Module – II

Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding). Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes, Analog Transmission: Digital to analog conversion. Textbook1: Ch

Textbook 1: Chapter 4.1 to 4.3, 5.1 (08 Hours)

Module – III

Bandwidth Utilization: Multiplexing and Spread Spectrum, Switching: Introduction, Circuit Switched Networks and Packet switching. Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum.

Textbook 1: Chapter 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.4 (08 Hours)

Module – IV

Data link control: DLC services, Data link layer protocols, Point to Point protocol (Framing, Transition phases only). Media Access control: Random Access, Controlled Access and Channelization, Introduction to Data-Link Layer: Introduction, Link-Layer Addressing, ARP IPv4 Addressing and subnetting: Classful and CIDR addressing, DHCP, NAT

Textbook 1: Chapter 9.1, 9.2, 11.1, 11.2 11.4, 12.1 to 12.3, 18.4 (08 Hours)

Module – V

Other wireless Networks: WIMAX, Cellular Telephony, Satellite networks, Network layer Protocols: Internet Protocol, ICMPv4, Mobile IP, Next generation IP: IPv6 addressing, The IPv6 Protocol, The ICMPv6 Protocol and Transition from IPv4 to IPv6.

Textbook1: 15.1 to 15.3, 16.2 **(08 Hours)**

Course Outcomes:

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

CO1: Perceive the different types of Networks and demonstrate the responsibility each layer of TCP/IP protocol suite.
CO2: Enumerate signal transmission along with impairments and performance analysis
CO3: Explore the concept of data and signal with different techniques
CO4: Review and analysis of bandwidth utilization and transmission media
CO5: Summarize IEEE 802.xx standards

Textbooks

1. Behrouz A. Forouzan, **Data Communications and Networking 5E**, 5th Edition, Tata McGraw-Hill, 2013

Reference Books

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007

Alternate Assessment Tools (AATs) suggested:

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

Web links / e – resources:

1. https://elcom-hu.com/Subjects/Computer/Compulsory/Communication/Data-Communications-and-Network-5e.pdf
2. https://ptgmedia.pearsoncmg.com/images/9780133814743/samplepages/9780133814743.pdf

Lab Components
(Using CISCO Packet Tracer / MATLAB / NS3 Simulator)

1. To analyze the performance of various configurations and protocols in LAN.
2. To construct a VLAN and make the PC's communicate among a VLAN.
3. To construct a Inter - VLAN and make the PC's communicate among a VLAN.
4. To construct a Wireless LAN and make the PC's communicate wirelessly.
5. To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP).

SEMESTER – V

Machine Learning (4:0:0:0) 4

(Effective from the academic year 2025-26)

Course Code	BAI503	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

- To provide a comprehensive introduction to the concepts and methodologies of machine learning.
- To understand and apply different machine learning algorithms to real-world problems.
- To develop skills to preprocess and analyze data for machine learning applications.
- To gain experience in evaluating and improving the performance of machine learning models.
- To foster the ability to design, implement, and deploy machine learning systems.

Preamble: The course in Machine Learning provides a comprehensive exploration into the theories, algorithms, and applications that underpin this rapidly evolving field. Designed to equip students with both theoretical knowledge and practical skills, the curriculum begins with an introduction to the foundational concepts of machine learning, tracing its historical development and delineating its key categories: supervised, unsupervised, and reinforcement learning.

Module – I

Introduction: Well – Posed Learning Problems, Designing a Learning System, Perspectives, and Issues in Machine Learning.

Concept Learning and the General-to-Specific Ordering: A Concept Learning Task, Concept Learning as Search, FIND-S, Version Spaces and the Candidate-Elimination Algorithm, Inductive Bias.

Textbook 1: Chapters 1 & 2 **(08 Hours)**

Module – II

Supervised Learning: Classification and Regression, Generalization, Overfitting, and Underfitting, Supervised ML Algorithms, Uncertainty Estimates from Classifiers.

Textbook 2: Chapter 2 **(08 Hours)**

Module – III

Unsupervised Learning and Preprocessing: Types of Unsupervised Learning, Challenges in Unsupervised Learning, Preprocessing & Scaling, Dimensionality reduction, Feature extraction, and Manifold Learning, Clustering.

Textbook 2: Chapter 3 **(08 Hours)**

Module – IV

Representing Data and Engineering Features: Categorical Variables, Binning, Discretization, Linear Models, and Trees, Interaction and Polynomials, Univariate Nonlinear Transformations, Automatic Feature Selection.

Textbook 2: Chapter 4 **(08 Hours)**

Module – V

Model Evaluation and Improvement: Cross Validation, Grid Search, Evaluation Metrics and Scoring.

Textbook 2: Chapter 5 **(08 Hours)**

Course Outcomes:

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

CO1: Demonstrate an understanding of the fundamental concepts of machine learning.

CO2: Apply supervised learning models for classification and regression tasks.

CO3: Apply unsupervised learning techniques to real-world data, addressing the challenges inherent in such tasks.

CO4: Analyze the impact of different feature engineering techniques on model performance and interpretability.

CO5: Evaluate the performance of machine learning models using appropriate cross-validation techniques and evaluation metrics.

Textbooks

1. "**Machine Learning",** Tom Mitchell, McGraw Hill, 1997. ISBN: 0070428077

2. "**Introduction to Machine Learning with Python**", Andreas C. Müller and Sarah Guido, Published by O'Reilly Media, Sixth Indian Reprint: January 2022, ISBN: 978-93-5213-457-1.

Reference Books

1. **"Pattern Recognition and Machine Learning"**, Christopher M. Bishop, Springer, 2006, ISBN-10: 0-387-31073-8, ISBN-13: 978-0387-31073-2.

2. **"Introduction to Machine Learning"**, Ethem Alpaydin, 3rd Edition, The MIT Press Cambridge, Massachusetts, ISBN: 978-0-262-02818-9.

Alternate Assessment Tools (AATs) suggested:

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

Web links / e – resources:

1. https://onlinecourses.nptel.ac.in/noc24_cs101
2. https://github.com/ageron/handson-ml2

DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING
Choice Based Credit System (CBCS)
SEMESTER – V

Machine Learning Lab (0:0:2:0) 1
(Effective from the academic year 2025-26)

Course Code	BAIL504	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2:0	SEE Marks	50
Total Number of Contact Hours	15	Exam Hours	3 Hours

Course Objectives:
This course will enable students to:

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.
- To Outline predictions using machine learning algorithms

Preamble: Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the theory and practical algorithms for machine learning from a variety of perspectives. We cover topics such as, Decision tree (ID3 Algorithm), Backpropagation Algorithm, Naïve Bayesian classifier, Bayesian Network, k-Means Algorithm, k-Nearest Neighbour Algorithm, Linear and Logistic Weighted Regression Algorithm, SVM, K-Means and PCA.

Sl. No.	Laboratory Programs
1	**Data Exploration and Visualization** • Load a dataset (e.g., Iris dataset or Titanic dataset). • Perform basic data exploration: check for missing values, data types, and summary statistics. • Create visualizations such as histograms, scatter plots, and box plots to understand the data distribution and relationships between features
2	**Linear Regression** • Load a dataset with a continuous target variable (e.g., Boston Housing dataset). • Implement a simple linear regression model to predict the target variable. • Visualize the regression line and the residuals.
3	**Logistic Regression** • Load a binary classification dataset (e.g., Titanic dataset or Breast Cancer dataset). • Implement a logistic regression model to predict the target variable. • Evaluate the model using accuracy, precision, recall, and the confusion matrix.
4	**k-Nearest Neighbours (k-NN)** • Load a dataset suitable for classification (e.g., Iris dataset). • Implement the k-NN algorithm and classify the data points. • Experiment with different values of k and visualize the decision boundaries.
5	**Decision Trees** • Load a dataset (e.g., Titanic dataset or Iris dataset). • Implement a decision tree classifier to predict the target variable. • Visualize the decision tree and understand the decision rules.
6	**Clustering with K-means** • Load a dataset suitable for clustering (e.g., Iris dataset without labels). • Implement the K-means clustering algorithm to group the data points.

	• Visualize the clusters and the cluster centres.
7	**Support Vector Machines (SVM)** • Implement an SVM classifier to classify handwritten digits using the MNIST dataset.
8	**Principal Component Analysis (PCA)** • Load a high-dimensional dataset (e.g., MNIST dataset). • Implement PCA to reduce the dimensionality of the data. • Visualize the explained variance and the data in the reduced dimensional space.

Course Outcomes:

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

CO1: Understand complexity of Machine Learning algorithms and their limitations

CO2: Describe the implementation procedures for the Machine Learning algorithms

CO3: Be Capable of confidently applying common Machine Learning algorithms to solve real-world data .

Textbooks

1. **Machine Learning** Tom M. Mitchell, , India Edition 2013, McGraw Hill Education.
2. "**Introduction to Machine Learning with Python**" by Andreas C. Müller and Sarah Guido, Ethem Alpaydın, —Introduction to Machine Learning, MIT Press

Web links / e – resources:

1. https://onlinecourses.nptel.ac.in/noc24_cs101
2. https://github.com/ageron/handson-ml2

DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING
Choice Based Credit System (CBCS)
SEMESTER – V

Blockchain Technology (3:0:0:0) 3
(Effective from the academic year 2025-26)

Course Code	BAI505A	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

- Get acquainted with the concept of Block chain and Distributed ledger system
- Learn and Explore blockchain platforms such as Ethereum, Hyperledger to build blockchain applications.
- Learn the cryptographic principles behind blockchain and understand concepts like consensus, crypto-currency, smart contracts, use cases
- Develop simple decentralized applications using blockchain .

Preamble: The purpose of this course is to introduce the foundation of blockchain technology. Blockchain is an emerging technology platform for developing decentralized applications and data storage, over and beyond its role as the technology underlying the cryptocurrencies. The basic of this platform is that it allows to create a distributed and replicated ledger of events, transactions, and data generated through various IT processes with strong cryptographic guarantees of tamper resistance, immutability, and verifiability. The global blockchain market size is expected to grow from USD 3.0 billion in 2020 to USD 39.7 billion by 2025. The objective of this course is to provide conceptual understanding of how blockchain technology can be used to innovate and improve business processes

Module – I

Blockchain: Distributed Systems, Introduction to blockchain, Features of Blockchain, Application of blockchain technology, types of blockchain ,CAP Theorem and blockchain, Benefits and Limitations of Blockchain

Textbook 1: Chapter 1 **(08 Hours)**

Module – II

Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Blockchain and full ecosystem of decentralization, Smart Contract, Decentralized organizations, Decentalized autonomous organizations, Decentralized Autonomous Corporations , Decentralized Autonomous Societies, Decentralized Applications , Platforms for Decentralization.

Cryptography: Cryptography, Authentication, Integrity, cryptographic primitives, Symmetric Cryptography, Data Encryption Standard, Advanced Encryption Standard , Assymetric Cryptography, public and private keys,Hash Functions ,ECDSA

Textbook 1: Chapter 2 , Chapter 3 **(08 Hours)**

Module – III

Bitcoins and Alternative Coins:Bitcoin, Transactions, Blockchain, Bitcoin Payments

Alternative coins: Theoretical Foundations, Bitcoin Limitations, Namecoin, Litecoin, Prime coin, Zcash, smart contracts, Definition, Ricardian Contracts

Ethereum : Introduction, Ethereum Blockchain, Elements of the ethereum Blockchain

Textbook 1: Chapter 4, Chapter 5, Chapter 6, Chapter 7 **(08 Hours)**

Module – IV

Ethereum : Precompiled contracts, Accounts, Block,Ether, messages, Minin, Clients and Wallets,Ethereum Network

HyperLedger: Projects, Hyperledger as a protocol, Fabric, Hyperledger Fabric, Sawtooth Lake,Corda

Blockchain- Outside of currencies: Internet of things, Government, health, Finance

Textbook 1: Chapter 7, Chapter 9, Chapter 11 **(08 Hours)**

Module – V

Blockchain Application Development: Decentralized Applications, Blockchain Applicationdevelopment, interacting with the Bitcoin Blockchain, Interacting programmatically with ethereum- sending transaction, Interacting Programmatically with ehereum- creating smart contract, Interactingprogrammatically with ethereum- executing smart

Textbook 2: Chapter 5 **(08 Hours)**

Course outcomes:

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

CO1: Explain the fundamental concepts and working platforms of blockchain technology. CO2: Make use of blockchain technologies for operational aspects of crypto currencies

CO3: Analyze the use of smart contracts and its use cases

CO4: Test for simple blockchain applications.

Textbooks

1. **Mastering Blockchain ,**Imran Bashir, Packt> Publishers, 2017
2. **Beginning Blockchain ,** Bikramadithya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress Publishers, Print year 2023

Reference Books

1. BlockChain Applications , by Harshadeep Bahga, Vijay Madaisetti, Published by Harshadeep Bahga, Vijay Madaisetti
2. Blockchain for Beginners, by Yatish R, Tejaswini, Publisher: Shroff/X-Team,2019

Alternate Assessment Tools (AATs) suggested:

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks,IBM, Hacker earth, Math works)
- Model presentation
- Video

Web links / e – resources:

1. https://blockgeeks.com/guides/what-is-blockchain-technology/
2. https://onlinecourses.nptel.ac.in/noc20_cs01/preview
3. Introduction to Blockchain Technology and Applications by Prof. Sandeep Shukla, IIT Kanpur:"

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
Choice Based Credit System (CBCS)
SEMESTER – V

Computer Vision (3:0:0:0) 3
(Effective from the academic year 2025-26)

Course Code:	BAI505B	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:
This course will enable students to:
- Learn basic principles of image formation, image processing algorithms and different algorithms for recognition from single and multiple images
- Understand the core vision tasks - Learn methods for segmenting images into meaningful regions.
- Applications to video analysis, video surveillance, object recognition.

Preamble: Computer Vision(CV) is a field of Artificial Intelligence (AI) that enables computers to interpret and make decisions based on visual data from the world. This course will introduce students to the fundamental principles and techniques in computer vision, including image processing, feature extraction.

Module – I

Introduction and Image formation: What is computer vision? A brief history, Geometric primitives and transformations, Photometric image formation, The digital Camera, The Pinhole Perspective, Weak Perspective, Cameras with lenses, The Human Eye, Intrinsic and extrinsic parameters.
Textbook 1: Chapter 1 - 1.1 & 1.2, Chapter 2 - 2.1 to 2.3 (08 Hours)

Module – II

Early Vision - One Image: Linear filters and convolution, Shift invariant linear systems, Spatial frequency and Fourier transforms, Sampling and Aliasing, Filters as Templates, Local Image Feature: Computing and representing the image gradient.
Textbook 2: Chapter 4.1-4.5, 5.1-5.2 (08 Hours)

Module – III

Early Vision - Multiple Images: Stereopsis and Structure from motion
Textbook 2: Chapter 7.1-7.5, 8.1-8.3 (08 Hours)

Module – IV

Mid-level Vision: Segmentation by clustering: Important Applications, Image segmentation by clustering Pixels, Segmentation, Clustering and graphs. Grouping and model fitting: The hough transform, Fitting lines and planes.
Textbook 2: Chapter 9.1-9.4, 10.1-10.2 (08 Hours)

Module – V

High-level vision: Recognition, Registration, Smooth surfaces and their outlines
Textbook 1: Chapter 6.1-6.6
Textbook 2: Chapter 12.1-12.3, Chapter 13.1-13.3 (08 Hours)

Course Outcomes:

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

CO1: Implement fundamental image processing techniques required for computer vision.
CO2: Understand image formation process.
CO3: Perform shape analysis
CO4: Learn methods for segmenting images into meaningful regions.
CO5: Understand video processing and motion computation.

Textbooks

1. Computer Vision: Algorithms and Applications (CVAA), Richard Szeliski, Springer 2nd edition, 2020.
2. Computer Vision - A modern Approach, by D. Forsyth and J.Ponce, Prentice Hall, 2nd edition, 2012

Reference Books

1. Building Computer vision Applications using artificial Neural networks - With step-by-step. Examples in Opencv and Tensorflow with python, Shamshad, Apress, 2020
2. Simon J. D. Prince, Computer Vision: Models, Learning, and interface, Cambridge University, press, 2012

Alternate Assessment Tools (AATs) suggested:

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

Web links / e – resources:

1. **https://onlinecourses.nptel.ac.in/noc19_cs58/preview**
2. **https://nptel.ac.in/courses/108103174**
3. **https://www.youtube.com/channel/UCf0WB91t8Ky6AuYcQV0CcLw**

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
Choice Based Credit System (CBCS)
SEMESTER – V

Applications of Artificial Intelligence (3:0:0:0) 3
(Effective from the academic year 2025-26)

Course Code	BAI505C	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

- Introduce Artificial Intelligence in detail from its basics to future applications and tools of Industry 4.0
- Provide insights on technological advancements in AI and focus on preparing students and researchers for Industry 5.0
- Impart the importance of AI technologies in various domains like health care and agriculture.
- Discuss the available applications of AI for promoting early diagnosis of diseases.

Preamble: This syllabus explores AI applications in various domains like environmental management, biomedicine, healthcare, agriculture, and assistive technology, providing a comprehensive understanding of AI's transformative impact and future potential.

Module – I

Artificial Intelligence: What Is Artificial Intelligence, What Is Machine Learning? What Is Deep Learning? Artificial Intelligence Enterprise Applications, Artificial Intelligence and Gender.

Artificial Intelligence in Environmental Management: Current Work in AI for Environment, AI for Cleaner Air – Smart Pollution Control, AI for Water Preservation – Smart Water Management, AI for Better Agriculture – Smart Farming, AI for Better E-Waste Management – Smart Monitoring/ Control, AI for Climate Control – Smart Energy Optimization, Risks and Rewards of AI in Environmental Management.

Textbook 1: Chapters 2 and 3 **(08 Hours)**

Module – II

Artificial Intelligence in Medical Imaging: Introduction to Medical Imaging, Applying Artificial Intelligence (AI) in Medical Imaging, AI in Various Medical Imaging Modalities, AI in Computed Tomography, AI in Mammography, AI in Magnetic Resonance Imaging (MRI), AI in Medical Ultrasound (US), AI in Nuclear Medicine Imaging, Salient Features of AI in Medical Imaging.

Textbook 1: Chapter 4 **(08 Hours)**

Module – III

Artificial Intelligence in Systems Biology: Opportunities in Biomedicine and Healthcare: Opportunities in Agriculture, Biomedicine, and Healthcare: Introduction to Artificial Intelligence (AI). AI Methodologies and Algorithm for Systems Biology. Applications of Artificial Intelligence (AI) in Agriculture, Biomedicine, and Healthcare. Case Studies on AI in Systems Biology. Future Challenges in Artificial Intelligence.

Textbook 1: Chapter 7 **(08 Hours)**

Module – IV

Artificial Intelligence in Agriculture: Introduction, Agriculture – Never Die Business Until Humans Exist. Need for AI in Agriculture. Emerging Agricultural Technologies. Potential Agricultural Domains for Modernization. Can AI Transform Agricultural Scenario?

Textbook 1: Chapter 10 **(08 Hours)**

Module – V

Artificial Intelligence-Based Assistive Technology (AT): Introduction, Overview of AI on AT, A Transformative Impact of AI on AT, Extensive AT Applications Based on AI, AI Experience and AT for Disabled People in India, AI-Powered Technology for an Inclusive World, Research Perceptive Over AI Influence on AT, AI Implementation on Assistive Technologies – Pragmatic Approach.

Textbook 1: Chapter 13 **(08 Hours)**

Course outcomes:

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

CO1: Understand the application of AI in Environmental Management.
CO2: Infer the application of AI in Medical Imaging.
CO3: Describe the applications of AI in the Biomedicine & Healthcare sectors.
CO4: Explore the opportunities and challenges of adopting AI in Agriculture.
CO5: Illustrate the AI based assistive technological applications.

Textbooks

1. Kaliraj, P., & Devi, T. (Eds.). "Artificial Intelligence Theory, Models, and Applications" (1st ed.). CRC Press, Taylor & Francis Group, Boca Raton, ebook ISBN 9781032008097, Auerbach Publications, 2021. https://doi.org/10.1201/9781003175865

Reference Books:

1. Werner Dubitzky, Francisco Azuaje "**Artificial Intelligence Methods and Tools for Systems Biology**"Springer, Book series Computational Biology, 2004.
2. Tofael Ahamed "**IoT and AI in Agriculture: Self-sufficiency in Food Production to Achieve Society 5.0 and SDG's Globally**" Springer, 2023.
3. Adam Bohr and Kaveh Memarzadeh "**Artificial Intelligence in Healthcare**" ISBN 978-0-12-818438-Elsevier,2020, DOI:https://doi.org/10.1016/C2018-0-04097-9
4. Prashant K. Srivastava, Govind Chandra Pandey, Dhiraj Kumar Singh, and K. Arunkumar "**Data Science for Agriculture and Natural Resource Management**" Springer,2021

Alternate Assessment Tools (AATs) suggested:

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

Web links / e – resources:

1. **https://onlinecourses.nptel.ac.in/noc24_cs104/preview**
2. **https://cloud.google.com/discover/ai-applications?hl=en**

DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING
Choice Based Credit System (CBCS)
SEMESTER – V

Data Integration and Warehousing (3:0:0:0) 3
(Effective from the academic year 2025-26)

Course Code	BAI505D	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

- Discuss the concepts and understand ffoundational Data Integration Techniques
- know the concepts of the data sources and string matching.
- Learn the thoughts of Schema Matching and Schema Manipulation Operators
- Understand the concepts of Data Matching, Query Processing, Wrappers, Data Warehousing and Caching

Preamble: This course focuses on that latter world. It shows how database ideas have been broadened and deepened to accommodate external sources of information, to handle the distributed aspects of the Web and the issues that arise from mutual information sharing, and especially to deal with heterogeneity and uncertainty. This course covers the topics of techniques used in data integration: techniques for manipulating query expressions, for describing data sources, for finding matches across heterogeneous data and schemas, for manipulating schemas, for answering queries, for extracting data from the Web, and for warehousing and storing integrated data.

Module – I

Introduction: What Is Data Integration? , Why Is It Hard? Data Integration Architectures,
Foundational Data Integration Techniques: Manipulating Query Expressions, Review of Database Concepts, Query Unfolding, Query Containment and Equivalence, Answering Queries Using Views.

Textbook 1: Chapter 1 & 2 **(08 Hours)**

Module – II

Describing Data Sources: Overview and Desiderata, Schema Mapping Languages, Access-Pattern Limitations, Integrity Constraints on the Mediated Schema, Answer Completeness, Data-Level Heterogeneity.
String Matching: Problem Description, Similarity Measures, Scaling Up String Matching.

Textbook 1: Chapter 3 & 4 **(08 Hours)**

Module – III

Schema Matching and Mapping, Problem: Definition, Challenges of Schema Matching and Mapping, Overview of Matching and Mapping Systems, Matchers, Combining Match Predictions, Enforcing Domain Integrity Constraints, Match Selector, Reusing Previous Matches, Many-to-Many Matches, From Matches to Mappings.
General Schema Manipulation Operators: Model Management Operators, Merge, ModelGen, Invert,
Toward Model Management Systems.

Textbook 1: Chapter 5 & 6 **(08 Hours)**

Module – IV

Data Matching: Problem Definition, Rule-Based Matching , Learning-Based Matching, Matching by Clustering, Probabilistic Approaches to Data Matching , Collective Matching, Scaling Up Data Matching
Query Processing: Background: DBMS Query Processing, Background: Distributed Query Processing, Query Processing for Data Integration, Generating Initial Query Plans, Query Execution for Internet Data, Overview of Adaptive Query Processing, Event-Driven Adaptivity, Performance-Driven Adaptivity

Textbook1: Chapter 7&8 **(08 Hours)**

Module – V

Wrappers: Introduction, Manual Wrapper Construction, Learning-Based Wrapper Construction, Wrapper Learning without Schema, Interactive Wrapper Construction,
Data Warehousing and Caching: Data Warehousing, Data Exchange: Declarative Warehousing, Caching and Partial Materialization, Direct Analysis of Local, External Data

Textbook1: Chapter 9& 10 **(08 Hours)**

Course outcomes :

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

CO1 : Understand the data integration models and architectures.

CO2: Describe the data sources for mapping languages and string matching.

CO3: Demonstrate the working of Schema Matching and Mapping Problem based on Schema Manipulation Operators.

CO4: Recommend the usages of **Data Matching and Query Processing** to solve the real time problems.

CO5: Construct models that uses learning based wrappers and data warehousing

Textbooks

1. "Principles of Data Integration" by Anhai Doan, Alon Halevy, Zachary Ives. Morgan Kaufman, 2012.

Reference Books

1. Data Integration Blueprint And Modeling: Techniques For A Scalable And Sustainable Architecture (Paperback) (Ibm Press) 1st Edition By Anthony David Giordano
2. Managing Data In Motion: Data Integration Best Practice Techniques And Technologies (The Morgan Kaufmann Series On Business Intelligence) 1st Edition By April Reeve
3. Building the Data Warehouse by William H. Inmon, Fourth Edition, Wiley Publications (https://www.amazon.in/Building-Data-Warehouse-W-Inmon/dp/0764599445)

Alternate Assessment Tools (AATs) suggested:

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

Web links / e – resources:

1. https://www.youtube.com/playlist?list=PL0aRSCaII9Dccno9pILzZERRiPDFjyGhM
2. https://ecm.elearningcurve.com/Data-Integration-Fundamentals-and-Best-Practices-p/di-01-a.htm

DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING
Choice Based Credit System (CBCS)
SEMESTER – V

Research Methodology and IPR (2:0:0)2
Common to all Branches
(Effective from the academic year 2025-26for 2022 Scheme)

Course Code	BRMK507	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:0	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Explain research process and research problem.
2. Gain knowledge on research design, sampling survey and data collection.
3. Familiarized with Interpretation and report writing.
4. Understand the concept of IP, patent and copy right.
5. Enhance their knowledge on trademarks, industrial and IC layout design.

Module – 1

Research Methodology: Meaning of Research, Objectives of research, types of research, research approaches, Significance of research, Research Process: Formulating research problem, Research methods verses methodology, Research and scientific method. Criteria of good research.

Defining the Research Problem: What is a Research Problem? Selecting the Research Problem, Necessity of Defining the Problem, Techniques Involved in Defining a problem.

(06 Hours)

Module – 2

Research Design: Meaning of Research Design, Need for Research design, Feature of a Good Design. Research Design in case of exploratory research studies, descriptive and diagnostic research studies. Basic Principles of Experimental Designs.

Design of sampling survey: Sample Design: Objective, size of sample, parameter of interest, selection of proper sample design. Sampling errors, non-sampling errors.

Data Collection: Experiments and Surveys, collection of primary data: observation method. Collection of secondary data. Selection of appropriate method for data collection.

(05 Hours)

Module – 3

Interpretation and Report writing: Meaning of Interpretation, Techniques of Interpretation, Precautions in interpretation, Significance of report writing, Different steps in report writing, layout of the research report, Types of reports, Oral presentation, Mechanics of writing research report, Precautions for writing a research reports.

(05 Hours)

Module – 4

Introduction to IP: Various forms of IP, Importance of intellectual property, Trade policy reviews, Agreement on trips.

Patent: What is patent, condition for grant of patent, Temporal and spatial aspects of patent, right of patentee, Patent office and register of patent.

Copyright: Copyright and classes of work, meaning of publication, ownership of copyright, license of copyright, term of copyright, Internet and copyright issues.

(05 Hours)

Module – 5

Trademarks: Introduction to trademark, term of trademark, collective marks, certification trademarks.

Industrial Design: Registration of Design: Non-registrable designs under The Design Act 2000, Condition for registration of Industrial Designs. Term of Industrial Designs.

IC Layout Design: Integrated Circuits Layout Design, Grant of registration of IC Layout Design. (05 Hours)

Course Outcomes:

The students will be able to:

CO1: Illustrate research process and research problem.
CO2: Describe research design, sampling survey and data collection.
CO3: Explain the techniques of Interpretation and report writing.
CO4: Summarize the concept of IP, patent and copy right.
CO5: Discuss trademarks, industrial and IC layout design.

TEXTBOOKS:

1. CR Kothari and Gaurav Garg, Research Methodology, New Age International Publishers, 2020.
2. Neeraj Pandey, Khushdeep Dharni, "Intellectual Property Rights", PHI Learning, 2014.

REFERENCES:

1. Dinakar Deb, rajdeep Dey, Valentina, Engineering Research Methodology, Springer, 2019.
2. David V. Thiel, Research method for engineers, Cambridge University Press, 2014.
3. Prabhuddha Ganguli, "Intellectual Property Rights", Tata Mc-Graw –Hill, 2017.

DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING
Choice Based Credit System (CBCS)
SEMESTER – V

Environmental Studies (1:0:0) 1
Common to all Branches
(Effective from the academic year 2025-26for 2022 Scheme)

Course Code	BESK508	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Number of Lecture Hours	15	Exam Hours	01

CREDITS: 01

Course objectives:

This course will enable students to

1. Recognize the ecological basis for regional and global Environmental issues, and lead by example as an environmental steward.
2. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
3. Analyze the trans-national character of environmental problems and ways of addressing them, including interactions across local to global scales.
4. Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as environmentalists.

Module – 1

Biodiversity: Types, Value, Hot spots and Threats.
***Field work:** Visit to a local area to document environmental assets: River / Forest / Grassland / Hill.

(3 Hours)

Module – 2

Environmental Pollution & Abatement & Relevant Acts: Water, Soil and Air Pollution.

***Field work:** Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural, followed by observation and documentation of environmental pollution and recommendation of remedial measures.

(3 Hours)

Module – 3

Waste Management & Public Health Aspects & Relevant Acts: E-waste, Bio-medical & Hazardous wastes.
***Field work:** Visit to a Resource Management Facility or Waste Treatment Facility, followed by understanding of process and its brief documentation.

(3 Hours)

Module – 4

Global Environmental Concerns: Ground water depletion, Climate Change and Carbon Trading.
***Field work:** Visit to a Green Building, followed by understanding of process and its brief documentation.

(3 Hours)

Module – 5

Latest Developments in Environmental Pollution Mitigation: E.I.A., E.M.S., SDG.
*Field work: Visit to Environmental NGOs, followed by brief documentation.
Self-Study/Discussion on Case Studies**:** Environmental Stewardship

(3 Hours)

*** Any one Field Work is to be successfully accomplished. The same will be assessed for AAT.**

Course outcomes:
The students will be able to:
CO 1: Appraise the significance of ecological systems under the ambit of environment.
CO 2: Analyze for the consequences owing from anthropogenic interactions on the environmental processes.
CO 3: Recommend solutions in the Anthropocene Epoch, with an in-depth understanding of the interdisciplinary facets of environmental issues.
CO 4: Elucidate the trans-national character of environmental problems and ways of addressing them.
CO 5: Appraise latest developments, concerns and ethical challenges associated with Environmental Protection.

Text Book:

1. Rajesh Gopinath and N. Balasubramanya, "**Environmental science and Engineering**", 1st Edition, Cengage Learning India Private Limited, 2018.
2. J. S. Singh, S. P. Singh and S. R. Gupta, "**Ecology, Environmental Science and Conservation**", India, S. Chand Publishing, 2017.

References:

1. M. Gadgil and R. Guha, "This Fissured Land: An Ecological History of India", Univ. of California Press, 1993.
2. E. P. Odum and H. T. Odum, "Fundamentals of Ecology", Philadelphia: Saunders Publisher, 1971.
3. M. L. Mckinney, "Environmental Science systems & Solutions", Web enhanced Edition, City of Publisher, R. M. Publisher, 1996.