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# Bachelors(B.Voc) - Artificial Intelligence & Machine Learning

## Session: 2025-26

### Department of Computer Science & Engineering

## Sem: 6

| Semester: VI | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Course Title** | **Type of Course** | **L** | **T** | **P** | **Credits** |
| BMA601 | Advanced Machine Learning | Core | 3 | 0 | 0 | 3 |
| BMA602 | Network Security with AI | Core | 3 | 0 | 0 | 3 |
| BMA603 | Data and Visual analytics in AI | Core | 3 | 0 | 0 | 3 |
| BMA604 | Project-II | Skill based | 0 | 0 | 4 | 2 |
| BMA606 | Digital Signal processing | Core | 3 | 0 | 0 | 3 |
| BMA | XXX | MOOC | 0 | 0 | 0 | 3 |
| **Total** | | | **16** | **0** | **8** | **20** |
| **Elective-IV(Any one of the following)** | | | | | | |
| BMA 607 | Deep Learning | Discipline Elective-IV | 3 | 0 | 0 | 3 |
| BMA 608 | Block Chain Designing | | | | | |
| **Value Added Course** | | | | | | |
| BMA 609 | Personality Development programme | VAC | 2 | 0 | 0 | 2 |
| **Total** | | | **21** | **0** | **8** | **22** |

**Semester: VI**

**Course Title: Advanced Machine Learning**

**Course Code: BMA601**

| L | T | P | Credits |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**Total Hours-60**

**Learning Outcomes:**

1. Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc
2. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un- supervised learning
3. Design and implement various machine learning algorithms in a range of real- world applications

**Course Content**

**UNIT I** **15 Hours**

Linear Regression: Simple Linear Regression, Regression Line, Multiple Linear Regression, Multicollinearity, Model Assessment and Comparison, Variable Selection using RFE.

Logistic Regression: Univariate Logistic Regression, Sigmoid Curve, Odds and Log Odds, Multivariate Logistic Regression, Confusion Matrix and Accuracy, Model Evaluation

**UNIT II** **15 Hours**

Advanced Regression: Generalized Linear Regression, Regularized Regression, Ridge and Lasso Regression, Feature Selection

Naive Bayes: Conditional Probability, Bayes Theorem, Naïve Bayes for Categorical Data, Naïve Bayes for Text Classification

**UNIT III** **15 Hours**

Support Vector Machine:

Concept of hyperplane in 2D and 3D, Maximal Margin Classifier, Soft Margin Classifier, Slack variable, SVM kernels.

Tree Models: Decision Trees, Regression with Decision Trees, Algorithms for Decision Tree Construction, Truncation and Pruning, Random Forests.

**UNIT IV** **15 Hours**

Clustering: K-Means Clustering, Hierarchical Clustering, K-mode Clustering, DB scan Clustering.

Principal Component Analysis: Building blocks of PCA, PCA algorithm, Scree Plots.

**TEXT BOOKS**

T1: Mitchell T.M., Machine Learning, McGraw Hill (1997).

T2: Andreas C. Miller, Sarah Guido, Introduction to Machine Learning with Python, O'REILLY (2001).

**REFERENCE BOOKS**

R1: Bishop C., Pattern Recognition and Machine Learning, Springer-Verlag (2006).

**Course Title: NETWORK SECURITY**

**Course Code: BMA602**

| L | T | P | Credits |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**Total Hours: 60**

**Learning Outcomes:** After completion of this course, the learner will be able to:

1. Identify the different types of network devices and their functions within a network.
2. Describe network architectures and classifications.
3. Summarize the intrusion detection and its solutions to overcome the attacks.
4. Describe various network applications, and network security considerations.

**Course Contents**

**UNIT I** **12 Hours**

**Introduction:** Overview of computer networks, seven-layer architecture, TCP/IP suite of protocols, etc.MAC protocols for high-speed LANS, MANS and wireless LANs. (For Example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless Ethernet, etc.)

**UNIT II** **10 Hours**

**Fast Access Technologies:** ADSL, Cable Modem, etc. IP Multicasting, Multicast routing protocols, address assignments, session discovery, etc.

**UNIT III** **20 Hours**

**Ipv6:** Basic Protocol, extensions and options, support for QoS, security, etc., neighbors' discovery, auto configuration, routing. Changes to other protocols. Application Programming Interface for IPV6.Mobility in networks. Mobile IP, Difference between Private and Public IP addresses Security related issues, Firewall History, **Cryptography and its Types**: Introduction**, Features ofCryptography,** Steganography, Classical Cryptography and Quantum Cryptography, Custom Building Cryptography Algorithms (Hybrid Cryptography), Cryptology ,Encryption, PRG, PRF and PRP in Cryptography, Caesar Cipher in Cryptography.

**UNIT IV** **18 Hours**

**TCP/IP protocol:** TCP Extension for high-speed networks, transaction-oriented applications. Other new options in TCP. Network security at various layers. Secure- HTTP, SSL, ESP, Authentication header, distribution protocols, Digital signatures, digital certificates.

**Transaction Modes**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning **Suggested Readings**


- *William Stallings (2010). Network Security Essentials: Applications and Standards, Prentice Hall.*
- *Michael T. Goodrich and Roberto Tamassia (2011). Introduction to Computer Security, Addison Wesley.*
- *Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone. (2001). Handbook of Applied Cryptography, CRC Press.*

**Course Title: Data and Visual analytics in AI**

**Course Code: BMA603**

| L | T | P | Credits |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**Total Hours-60**

**Learning Outcomes:**

1. Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc
2. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un- supervised learning
3. Design and implement various machine learning algorithms in a range of real- world applications

**Course Content**

**UNIT I** **18 Hours**

Introduction

Data for Graphics, Design principles, Value for visualization, Categorical, time series, and statistical data graphics, Introduction to Visualization Tools

Graphics Pipeline and Aesthetics and Perception

Introduction, Primitives: vertices, edges, triangles, Model transforms: translations, rotations, scaling, View transform, Perspective transform, window transform, Graphical Perception Theory, Experimentation, and the Application, Graphical Integrity, Layering and Separation, Color and Information, Using Space

**UNIT II** **12 Hours**

Graphics Pipeline and Aesthetics and Perception

Introduction, Primitives: vertices, edges, triangles, Model transforms: translations, rotations, scaling, View transform, Perspective transform, window transform, Graphical Perception Theory, Experimentation, and the Application, Graphical Integrity, Layering and Separation, Color and Information, Using Space

**UNIT III** **15 Hours**

Visualization Design

Visual Display of Quantitative Information, Data-Ink Maximization, Graphical Design, Exploratory Data Analysis, Heat Map

Collaboration

Graph Visualization and Navigation, Online Social Networks, Social Data Analysis, Collaborative Visual Analytics, Text, Map, Geospatial data

**UNIT IV** **15 Hours**

Multidimensional Data and Interaction : Query, Analysis and Visualization of Multi- Dimensional Relational Databases, Interactive Exploration, tSNE, Interactive Dynamics for Visual Analysis, Visual Queries, Finding Patterns in Time Series Data, Trend visualization, Animation, Dashboard, Visual Storytelling

**Text Books/Suggested References:**

1. The Visual Display of Quantitative Information by E. Tufte, Graphics Press, 2nd Edition, 2001
2. Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, Khanna Publishing 2019.
3. Data Visualization Handbook by J. Koponen, J. Hildén, CRC Press, 2019
4. The Book of Trees: Visualizing Branches of Knowledge by M. Lima, Princeton Architectural Press, 2014
5. Handbook of Graph Drawing and Visualization by R. Tamassia, CRC Press, 2013
6. Interactive Data Visualization for the Web by S. Murray O'Reilly Press, 2nd Edition, 2017.

**Course Title: PROJECT -II**

**Course Code: BMA604**

| L | T | P | Credits |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

**Total Hours: 30**

**Learning Outcomes:** After completion of this course, the learner will be able to:

1. Use latest multimedia devices and programming software.
2. Design and construct a hardware and software system, component or process to meet desired needs.
3. Classify the multidisciplinary Problems of project.
4. Work as professionals, with portfolio ranging from data management, network configuration, designing hardware, database and software design to management and administration of entire systems.

**Course Content**

Project should include following phases: System Analysis and Design
Coding - Implementation Testing, It should be a working project Must have a future perspective.

The Domain of project can be from:
Databases Application
software System
software Multimedia
Web Applications, etc.

A complete project report must be submitted along with softcopy of project. Project report may include Requirements of Project, Flow Chart, DFD's, Coding and Test Results

**Course Title: Digital Signal Processing**

**Course Code: BMA605**

| L | T | P | Credits |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**Total Hours: 60**

**Learning Outcomes**: After completion of this course, the learner will be able to:

1. Determine the hardware and operating system requirements for digital forensics
2. Compare and Analysis of digital forensics by organization of data and metadata in computer systems.
3. Analyze file recovery and hidden file extraction techniques and Integrate security of computer systems with digital forensics and evaluate its performance.
4. Identify various types of forensics in the arena of information technology and Critic the computer crimes by studying the security Laws and legal Landscape around the world.

**Course Content**

**UNIT I** **15 Hours**

Introduction to Digital Forensics: digital crimes, digital investigation, evidence, extraction, preservation etc.; overview of hardware and operating systems: structure of storage media/devices, Windows/Macintosh/Linux registry, boot process; disk and file system analysis, data acquisition of physical storage devices

**UNIT II** **15 Hours**

Data recovery: identifying hidden data, recovering deleted files; digital evidence controls: uncovering attacks that evade detection by event viewer, task manager and other windows GUI tools; disk imaging, recovering swap files, temporary and cache files; automating analysis and extending capabilities.

**UNIT III** **18 Hours**

Network Forensics: collecting and analyzing network-based evidence, reconstructing web browsing, email activity, intrusion detection, tracking offenders, windows registry changes, etc.; Mobile Network forensics: introduction, investigations, collecting evidences, where to seek digital data for further investigations; Email and database forensics; memory acquisition

**UNIT IV** **12 Hours**

Computer crime and legal issues: intellectual property, privacy issues, criminal justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation and deposition of legal evidence in a court of law.

**Transaction Modes**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

**Suggested Readings**

- *Thomas J Holt, Adam M Bossler, Kathryn C Seigfried-Spellar, Cybercrime and Digital Forensics: An Introduction, Routledge, 2015.*
- *Cory Altheide and Harlan Carvey, Digital Forensics with Open-Source Tools, Elsevier publication, April 2011.*
- *B. Nelson, A. Phillips, F. Enfinger, C. Steuart, Guide to Computer Forensics and Investigations 4 th edition, Thomson, 2009.*
- *Campbell, A. (2011) Report of the Fingerprint Inquiry Scotland*
- *Miller, C. G. (2013) 'Fingerprint identification not infallible, nor scientific & based on fraud', cliffordmiller law,*

***Web lINKS***

- *https://nij.ojp.gov/digital-evidence-and-forensics- Digital Forensics*
- *https://dl.acm.org/doi/fullHtml/10.1145/3503047.3503082- Digital Forensics*

**Course Title: Deep Learning**

**Course Code: BMA606**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Total Hours: 45**

**Learning Outcomes:**

After completion of this course, the learner will be able to:

1. Understand the methods and terminologies involved in deep neural network, differentiate the learning methods used in Deep-nets.
2. Identify and apply suitable deep learning approaches for given application.
3. Design and develop custom Deep-nets for human intuitive applications
4. Design of test procedures to assess the efficiency of the developed model.

**Course Content**

**UNIT I** **10 Hours**

Introduction

History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed Forward Neural Networks, Back propagation

**UNIT II** **15 Hours**

Activation functions and parameters

Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, Principal Component Analysis and its interpretations, Singular Value Decomposition, Parameters

v/s Hyper-parameters

**UNIT III** **10 Hours**

Auto-encoders & Regularization

Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Encoder Decoder Models, Attention Mechanism, Attention over images, Batch Normalization

**UNIT IV** **10 Hours**

Deep Learning Models

Introduction to CNNs, Architecture, Convolution/pooling layers, CNN Applications, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Introduction to RNNs, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs

Deep Learning Applications

Image Processing, Natural Language Processing, Speech recognition, Video Analytics

**Course Title: BLOCK CHAIN ARCHITECTURE DESIGN**

**Course Code: BMA607**

| L | T | P | Credits |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Total Hours: 45**

**Learning Outcomes:** After completion of this course, the learner will be able to:

1. Understand the basic concepts and technology used for block chain
2. Describe the primitives of the distributed computing and cryptography related to block chain.
3. Apply security features in block chain technologies.
4. Use smart contract in real world applications.

**Course Content**

**UNIT1** **10 Hours**

**Introduction to Block chain:** Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, And Privacy. Block chain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hash chain to Block chain, Basic consensus mechanisms

**UNIT II** **10Hours**

**Consensus:** Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Block chain consensus protocols Permissioned Block Chain Design goals, Consensus protocols for Permissioned Block chain.

**UNIT III** **15 Hours**

**Hyper ledger Fabric (A):** Decomposing the consensus process, Hyper ledger fabric components, Chain code Design and Implementation

**Hyper ledger Fabric (B):** Beyond Chain code: fabric SDK and Front End (b) Hyper ledger composer tool

**UNIT IV** **10 Hours**

**Use case 1:** Block chain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance

**Use case 2:** Block chain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc 08 V

**Use case 3:** Block chain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems Block Chain Cryptography, Privacy and Security on Block chain. **Transaction Modes**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

**Suggested Readings**


- *Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction", Princeton University Press (2016).*
- *Josh Thompson, 'Block chain: The Block chain for Beginnings, Guild to Block Chain Technology and Block Chain Programming', Create Space Independent Publishing Platform, 2017.*
- *Imran Bashir, "Mastering Block chain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing, 2017.*
- *Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Block Chain Applications Using Ethereum-supported Tools, Services, and Protocols", Packet Publishing, 2018.*

| L | T | P | Credits |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Title: PERSONALITY DEVELOPMENT PROGRAMME**

**Course Code: BMA608**

**Total Hours:30**

**Course Learning Outcome:** On successful completion of this course, the students will be able to:

1. Assess the commercial viability of new technologies, business opportunities and existing companies
2. Plan, organize, and execute a project or new venture with the goal of bringing new products and service to the market
3. Carry out scientific research in the field of entrepreneurship
4. Improved your interpersonal and collaborative skills
5. Write scientific reports and communicate the results in a professional manner

**UNIT-I** **10Hours**

**Introduction to Generic Skills:** Importance of Generic Skill Development (GSD), Global and Local Scenario of GSD, Life Long Learning (LLL) and associated importance of GSD.
**Managing Self:** Knowing Self for Self Development- Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc., Managing Self – Physical- Personal grooming, Health, Hygiene, Time Management, Managing Self – Intellectual development -Information Search: Sources of information, Reading: Purpose of reading, different styles of reading, techniques of systematic reading, Note Taking: Importance of note taking, techniques of note taking, Writing: Writing a rough draft, review and final draft. Managing Self – Psychological, Stress, Emotions, Anxiety-concepts and significance, Techniques to manage the above.

**UNIT-II** **5Hours**

**Managing in Team:** Team - definition, hierarchy, team dynamics, Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background, Communication in group - conversation and listening skills.

**UNIT-III** **10 Hours**

**Task Management:** Task Initiation, Task Planning, Task execution, Task close out, Exercises/case studies on task planning towards development of skills for task management

**Problem Solving:** Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving, Different approaches for problem solving. Steps followed in problem solving. Exercises/case studies on problem solving.

**UNIT-IV** **5Hours**

**Entrepreneurship:** Introduction, Concept/Meaning and its need, Competencies/qualities of an entrepreneur, Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level. Market Survey and Opportunity Identification (Business Planning)- How to start a small scale industry, Procedures for registration of small-scale industry, List of items reserved for exclusive manufacture in small-scale industry, Assessment of demand and supply in potential areas of growth, understanding business opportunity, Considerations in product selection, Data collection for setting up small ventures.

Project Report Preparation- Preliminary Project Report, Techno-Economic Feasibility Report, Exercises regarding "Project Report Writing" for small projects.