

Industry Partner



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

2025-26

Session:

Department of Computer Science & Engineering

Sem: 6

S emester: VI

C ourse C ode	C ourse T itle	T ype of Course	L	T	P	C redits
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
E lective-IV(Any one of the following)			1	6	0	8
	Deep Learning					
BMA 607						
BMA 608	Block Chain Designing	Discipline Elective IV	3	0	0	3
V alue A dded C ourse						
BMA 609	Personality Development programme	VAC	2	0	0	2
T otal			2	1	0	8
						22

S emester: VI**C ourse Title: Advanced Machine Learning**

L	T	P	C redits
4	0	0	4

T otal Hours-60**L earning 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

C ourse Objectives**U NIT I** **1 5 Hours**

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

U NIT II Logistic Regression: Univariate Logistic Regression, Sigmoid Curve, Odds and Log Odds, **1 5 Hours**
Multivariate Logistic Regression, Confusion Matrix and Accuracy, Model Evaluation

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

U NIT III Naive Bayes: Conditional Probability, Bayes Theorem, Naïve Bayes for Categorical Data, Naïve Bayes for Text Classification **1 5 Hours**

Support Vector Machine:

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

U NIT IV Tree Models: Decision Trees, Regression with Decision Trees, Algorithms for Decision Tree
1 5 Hours
Construction, Truncation and Pruning, Random Forests.

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

T EXT BOOKS

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

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

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

R EFERENCE BOOKS

R1: Bishop C., Pattern Recognition and Machine Learning, Springer-Verlag (2006).
(2001).

Course Title: NETWORK SECURITY**Course Code: BMA602**

L	T	P	C redits
			4

4T otal H ours: 60**L earning Outcomes:**

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

- Identify the different types of network devices and their functions within a network.
- Describe network architectures and classifications.
- Summarize the intrusion detection and its solutions to overcome the attacks.

U NIT I Course Contents**1 2 Hours****I ntroduction:**

- Describe various network applications, and network security considerations. 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.)

1 0 Hours**F ast A ccess T echnologies:**

- ADSL, Cable Modem, etc. IP Multicasting, Multicast routing protocols, address assignments, session discovery, etc.

2 0 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 related issues, Firewall History, Cryptography and its Types: Introduction, IPv6 Mobility in networks, Mobile IP, Difference between Private and Public IP addresses Security Features of Cryptography.

- Steganography, Classical Cryptography and Quantum Cryptography, Custom Building Cryptography Algorithms (Hybrid Cryptography), Cryptology, Encryption, PRG, PRF and PRP in Cryptography, Caesar Cipher in Cryptography.

1 8 Hours**T CP/IP p rotocol:**

TCP Extension for high-speed networks, transaction-oriented applications.

Other new options in TCP. Network security at various layers. Secure- HTTP, SSL, ESP,

T ransaction Modes

Teaching, Self-Learning, Collaborative Learning and Cooperative Learning S uggested Readings Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Authentication header, distribution protocols, Digital signatures, digital certificates.

• William Stallings (2010) *Network Security Essentials: Applications and Standards*, Prentice Hall.

- W esley.

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

Course Complaints

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

U NIT IV**1 5 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**C**ourse Code: BMA604

L	T	P	C credits
0	0	4	2

Total Hours: 30**L**earning 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.

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 ~~Course content~~ computer crimes by studying the security Laws and legal Landscape around the world.

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, **15 Hours** data acquisition of physical storage devices

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 **18 Hours** extending capabilities.

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 **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

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, Teaching, Self-Learning, Collaborative Learning and Cooperative Learning, 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://nij.ojp.gov/digital-evidence-and-forensics-Digital%20Forensics)
- [https://dl.acm.org/doi/fullHtml/10.1145/3503047.3503082-Digital Forensics](https://dl.acm.org/doi/fullHtml/10.1145/3503047.3503082-Digital%20Forensics)

Course Title: Deep Learning

L	T	P	Credits
3	0	0	3

Course Code: BMA606

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

Course Content

10 Hours

4. Design of test procedures to assess the efficiency of the developed model.

UNIT I

History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptrons (MLPs),

UNIT II Representation Power of MLPs, Sigmoid Neurons, Feed Forward Neural Networks, Back propagation **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

UNIT III
v/s Hyper-parameters**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, **UNIT IV** Batch Normalization **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

L	T	P	Credits
3	0	0	3

Course Title: BLOCK CHAIN ARCHITECTURE DESIGN**Course Code: BMA607****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.

Course Content**10 Hours**

4. Use smart contract in real world applications.

Digital Money to Distributed Ledgers, Design Primitives: Protocols, **UNIT 1** 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** **10 hours**

C onsensus:

U NIT III 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. **15 Hours**

H yper ledger F abric (A):

H yper ledger F abric (B): Decomposing the consensus process, Hyper ledger fabric components, Chain code Design and Implementation

U NIT IV Beyond Chain code: fabric SDK and Front End (b) Hyper ledger composer tool **10 Hours**

U se c ase 1 :

U se c ase 2 : Block chain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance

U se c ase 3 : Block chain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc 08 V

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

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

S uggested Readings

- *Comprehensively Tackling Blockchain and Cryptocurrency Technologies – A Practical Guide to Blockchain and Cryptocurrency* (Buterin), 2016
- *Josh Thompson, ‘Blockchain: The Blockchain for Beginners, Guide to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017.*
- *Imrar Bashir, “Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained”, Packt Publishing, 2017.*
- *Merunas Grincalaitis, “Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols”, Packt Publishing, 2018.*

L	T	P	C 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

- 5 . Write scientific reports and communicate the results in a professional manner
4. Improved your interpersonal and collaborative skills

UNIT-I

10Hours

Introduction to Generic Skills:

Managing Self: Importance of Generic Skill Development (GSD), Global and

Local Scenario of GSD, Life Long Learning (LLE) and associated importance of GSD, 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.

5 Hours

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.

U NIT-III

10 Hours

T ask M anagement:

Task Initiation, Task Planning, Task execution, Task close out, Exercises/case
Problem Solving: Training towards development of skills for task management

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

5 Hours**E ntrepeneurship:**

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.

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