

 Estd. 1962 "A++" Accredited by NAAC (2021) With CGPA 3.52	SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA PHONE: EPABX-2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४, महाराष्ट्र दूरध्वनी-ईपीएबीएक्स -२६०९०००, अभ्यासमंडळे विभाग दूरध्वनी ०२३१-२६०९०९४ ०२३१-२६०९४८७	 
---	---	---

Ref.No.SU/BOS/Science/150

Date: 26/05/2026.

The Principal,
 All Concerned Affiliated Colleges/Institutions
 Shivaji University, Kolhapur

The Head/Co-ordinator/Director
 All Concerned Department (Science)
 Shivaji University, Kolhapur.

Subject: Regarding revised syllabi of degree programme under the Faculty of Science and Technology as per NEP-2020.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of degree programme under the Faculty of Science and Technology as per NEP-2020.

1.	B.Sc. Part II Medicinal Chemistry (Entire) (2.0)	6.	BCA Part III
2.	B.A./B.A.B.Ed Part III Geography (2.0)	7.	B.Sc. Part II Data Science
3.	B.Sc. Part II Artificial Intelligence	8.	B.Sc.-M.Sc. Part III AI & ML
4.	B.Sc.-M.Sc. Part IV Nano Science and Technology (1.0)	9.	MCA Part II (YCSRD)
5.	B.Sc.-M.Sc. Part III Nano Science and Technology (2.0)	10.	MCA Part II

This syllabus, nature of question and equivalence shall be implemented from the academic year 2026-2027 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in>Syllabus>Syllabus as per NEP2020.

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2026 & March/April 2027. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,



Dy Registrar

Encl: as above

for information and necessary action

Copy to:

1	Dean, Faculty of Science & Technology	6	Appointment Section A & B
2	Director, Board of Examinations and Evaluation	7	I.T.Cell /Computer Centre
3	Chairman, Respective Board of Studies	8	Eligibility Section
4	B.A.,OE-II & B.Sc.-M.Sc. Exam Section	9	Affiliation Section (T.1) (T.2)
5	Internal Quality Assurance Cell (IQAC Cell)	10	P.G. Seminar Section

SHIVAJI UNIVERSITY, KOLHAPUR



NAAC A++ Grade with CGPA 3.52

As per
National Education Policy (NEP-2020)

Syllabus for
B.Sc.-M.Sc. (AI-ML)
Five year Integrated Programme
(Under Faculty of Science and Technology)

PART-III SEMESTER V & VI

(Syllabus to be implemented from Academic Year 2026-27)

B.Sc- M.Sc. (AI-ML) Part III Semester V & VI

(NEP-2020)

Syllabus to be implemented from Academic year 2026-27

Semester V

B.Sc- M.Sc. (AI-ML) Part -III SEMESTER-V (Duration- Six Month)										
Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
		Lectur es per wee K	Practical Per week	Credit	Maxim um Marks	Minim um Marks	Exam minute	Maximum Marks	Minimu m Marks	Exam minute s
1	Major IX: Machine Learning	2	-	2	40	14	90	10	04	20
2	Major X : Deep Learning	2	-	2	40	14	90	10	04	20
3	Major Practical V (a): Machine Learning Lab (P)	-	4	2	40	14	90	10	04	20
4	Major Practical V (b): Deep Learning Lab (P)	-	4	2	40	14	90	10	04	20
5	Major Elective I ✓ Front End Development ✓ PHP	2	-	2	40	14	90	10	04	20
6	Major Practical-I ✓ Front End Development Lab (P) ✓ PHP Lab(P)	-	4	2	40	14	90	10	04	20
7	Open Elective V: Prompt Engineering	2	-	2	40	14	90	10	04	20
8	VSC-II: Major specific: Basic AI Tools (P)	-	4	2	40	14	90	10	04	20
9	AEC-III: Corporate Culture & Communication	2	-	2	40	14	90	10	04	20
10	OJT : on Job Training (P)	-	-	4	80	28	180	20	08	40
	Total (A)			22	440			110		

B.Sc- M.Sc. (AI-ML) Part - III SEMESTER-VI (Duration- Six Month)										
Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
		Lectures Per week	Practical Per week	Credit	Maximum Marks	Minimum Marks	Exam minute	Maximum Marks	Minimum Marks	Exam minutes
1	Major XI: Natural Language Processing	2	-	2	40	14	90	10	04	20
2	Major XII: Computer Vision	2	-	2	40	14	90	10	04	20
3	Major Practical VI (a): Natural Language Processing Lab (P)	-	4	2	40	14	90	10	04	20
	Major Practical VI (b): Computer Vision Lab (P)	-	4	2	40	14	90	10	04	20
4	Major Elective II: ✓ Back End Development ✓ Advanced PHP	2	-	2	40	14	90	10	04	20
5	Major Practical II ✓ Back End Development Lab (P) ✓ Advanced PHP Lab (P)	-	4	2	40	14	90	10	04	20
6	VSC III: Major specific: Advanced AI Tools (P)	-	4	2	40	14	90	10	04	20
7	SEC III: Cyber Security	2	-	2	40	14	90	10	04	20
8	AEC IV: Professional Ethics & Corporate Skills	2	-	2	40	14	90	10	04	20
9	IKS: IKS for Computer Science	2	-	2	40	14	90	10	04	20
10	FP: Field Project (P)	-	-	2	40	14	90	10	04	20
	Total (B)			22	440			110		

Exit option after Level 6: Students can exit with Bachelor of Science in Artificial Intelligence and Machine Learning

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
Machine Learning

Course Outcomes:

After completion of this course students will be able to:

1. Acquire fundamental knowledge of developing machine learning models.
2. Describe the components of a learning system
3. Study phases of predicative modeling.
4. Demonstrate Learning with Trees.
5. Apply regression different techniques for solving prediction and classification problems.
6. Evaluate Machine Learning models using performance metrics

UNIT-I

(15 Hours)

Introduction to Machine Learning, Evolution of machine learning, Difference between AI and Machine learning, Developments in machine learning, Introduction to K-nearest neighbor method, different phases of predicative modeling. Aspects of Machine Learning, Definition of learning System, Goals and applications of machine learning, Aspects of developing a learning system: training data, concept representation, function approximation.

Unit – II

(15 Hours)

Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps in developing a Machine Learning Application. Training Error, Generalization error, Overfitting, Underfitting, Bias Variance trade-off. Learning with Regression and Trees, Learning with Regression: Linear Regression, Multivariate Linear Regression, Logistic Regression. Learning with Trees: Decision Trees, Constructing Decision Trees using Gini Index (Regression), Classification and Regression Trees (CART) Performance Metrics: Confusion Matrix, Kappa Statistics, Sensitivity, Specificity, Precision, Recall, F-measure, ROC curve.

Reference Books:

1. Peter Harrington, —Machine Learning n Action||, DreamTech Press
2. Ethem Alpaydın, —Introduction to Machine Learning||, MIT Press
3. Tom M. Mitchell, —Machine Learning|| McGraw Hill
4. Stephen Marsland, —Machine Learning An Algorithmic Perspective||, CRC Press

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
Deep Learning

Course Outcomes:

After completion of this course students will be able to:

1. Understand fundamentals of deep learning.
2. Learn different deep learning architectures.
3. Explore training techniques and optimization methods.
4. Apply CNN and RNN models
5. Understand different activation functions.
6. Apply deep learning in real-world applications

UNIT-I

(15 Hours)

Introduction to Deep Learning :Introduction to Artificial Intelligence, Machine Learning, Deep Learning, Difference between Machine Learning and Deep Learning, Applications of Deep Learning, Biological neuron and artificial neuron, Perceptron model, Multilayer Perceptron (MLP), Feedforward Neural Network, Activation functions: Sigmoid, ReLU, Tanh, Softmax, Gradient descent, Backpropagation algorithm, Overfitting and regularization

UNIT-II

(15 Hours)

Convolution Neural Networks (CNN) :Introduction to CNN, CNN architecture :Convolution layer, Pooling layer, Fully connected layer, Image classification using CNN, Applications: Face recognition, Image recognition, Introduction to sequence data, Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM), Applications.

Reference Books:

1. Goodfellow, Yoshua Bengio, Aaron Courville – Deep Learning
2. Francois Chollet – Deep Learning with Python
3. Aurélien Géron – Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow
4. Nikhil Buduma, Nicholas Locascio – Fundamentals of Deep Learning
5. Charu C. Aggarwal – Neural Networks and Deep Learning
6. Simon Haykin – Neural Networks and Learning Machines
7. Michael Nielsen – Neural Networks and Deep Learning
8. Christopher M. Bishop – Pattern Recognition and Machine Learning

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
Major Practical V(a): Machine Learning Lab

Course Outcomes:

After completion of this course students will be able to:

1. Perform data collection, preprocessing, cleaning, normalization, and visualization using appropriate tools and libraries.
2. Understand implementation of Machine Learning Algorithms
3. Implement supervised Machine Learning algorithms using programming tools like Python.
4. Train Machine Learning models and evaluate their performance using metrics

There will be around 40 programs based on Machine Learning Lab

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
Major Practical V(b): Deep Learning Lab

Course Outcomes:

After completion of this course students will be able to:

1. Design and implement basic deep Learning models using neural networks for classification and prediction problems.
2. Understand utilization of machine learning and deep learning libraries such as NumPy, Pandas etc.

There will be around 20 programs based on Deep Learning Lab

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
Front End Development

Course Outcomes:

After completion of this course students will be able to:

1. Understand the fundamentals of server-side JavaScript
2. Develop backend programming skills by implementing callback functions
3. Design and integrate databases with Node.js applications by creating schemas and performing CRUD operations using MongoDB.
4. Build RESTful web services by designing and implementing REST APIs using HTTP methods
5. Implement secure authentication mechanisms by applying JSON Web Token
6. Manage Node.js applications and system resources

UNIT I

(15 Hours)

Introduction to Nodejs, Architecture of Nodejs Application, Advantages of Node JS, Synchronous and

Asynchronous Programming, Call back Function in nodejs, Promises in Nodejs, Mongoddb with Nodejs, Design the Schema in Nodejs, Design the Rest API's, GET, POST, PUT, DELETE, JSON web Token, Authentication in nodejs, Create the Auth APP in nodejs

UNIT II

(15 Hours)

NodeJS Modules, Functions, Buffer, Module, Module Types, Core Modules, Local Modules, Module.Exports, NPM, Installing Packages Locally, Adding dependency in package.json, installing packages globally, updating packages, Fs.read File, Writing a File, Writing a file asynchronously, Opening a file, Deleting a file, Other IO Operations, When to use Event Emitters, Binding Functions to Events, Event Requests, Event Listening

Reference Books:

1. Node.js web development by David Herron
2. Beginning Node.js, Express & MongoDB Development by Greg Lim
3. Node.js Design Patterns by Mario Casciaro and Luciano Mammino

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
PHP

Course Outcomes:

After completion of this course students will be able to:

1. Understand fundamentals of web technologies.
2. Explore various PHP features.
3. Introduce students to server-side scripting using PHP.
4. Understand installing and configuring XAMPP/WAMP server
5. Develop dynamic and interactive web applications
6. Develop PHP programs using variables, operators, control structures, and user-defined functions.

UNIT I

(15 Hours)

Introduction to PHP, Introduction to Web Technologies, Client-side vs Server-side scripting, Introduction to PHP and its features, Installing and configuring XAMPP/WAMP server, PHP syntax and structure, Variables, constants, and data types, Operators in PHP: Arithmetic, Assignment, Comparison, Increment/Decrement, Logical, Conditional (Ternary), Array Operators etc .

UNIT II

(15 Hours)

Control Structures and Functions: Conditional statements: if, if-else, nested if, switch case, Looping statements: for loop, while loop, do-while loop, foreach loop, Functions in PHP, User-defined functions, Function with parameters and return values, Arrays in PHP, Indexed array, Associative array, Multidimensional array.

Reference Books:

1. Luke Welling and Laura Thomson – PHP and MySQL Web Development, Addison-Wesley Professional.
2. Robin Nixon – Learning PHP, MySQL, JavaScript, CSS & HTML5, O'Reilly Publications.
3. Steven Holzner – PHP: The Complete Reference, Tata McGraw-Hill.
4. Joel Murach and Ray Harris – Murach's PHP and MySQL, Mike Murach & Associates.
5. Larry Ullman – PHP for the Web: Visual QuickStart Guide, Peachpit Press.
6. Ivan Bayross and Sharanam Shah – PHP for Beginners, SPD Publications.

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
Major Practical-1: Front End Development Lab

Course Outcomes:

After completion of this course students will be able to:

1. Install and configure Node.js environment and demonstrate understanding of Node.js architecture, synchronous and asynchronous programming concepts.
2. Develop Node.js applications using callbacks, promises, and asynchronous programming
3. Design and implement RESTful APIs using HTTP
4. Develop database-driven applications using MongoDB with Node.js
5. Implement authentication and security mechanisms using JSON Web Tokens (JWT) and develop secure authentication applications.
6. Create Node.js applications using modules, file system operations, event handling, and NPM packages for scalable server-side development.

There will be around 25-30 programs based on Major Practical-1: Front End Development Lab

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
Major Practical-1: PHP Lab

Course Outcomes:

After completion of this course students will be able to:

1. Install and configure PHP development environment using local servers such as XAMPP or WAMP and execute basic PHP programs.
2. Develop PHP programs using variables, constants, data types, and operators for performing arithmetic and logical operations.
3. Implement decision-making constructs such as if, if-else, nested if, and switch case to control program flow.
4. Create PHP programs using looping constructs such as for, while, do-while, and foreach for repetitive tasks.
5. Design and implement user-defined functions with parameters and return values for modular and reusable code development.
6. Develop PHP applications using indexed, associative, and multidimensional arrays.

There will be around 25-30 programs based on Major Practical-1: PHP Lab

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
Open Elective V: Prompt Engineering

Course Outcomes:

After completion of this course students will be able to:

1. Understand the basic concepts and applications of prompt engineering.
2. Identify prompt structure, components, and types of prompting techniques.
3. Apply prompt design techniques to generate effective AI outputs.
4. Design optimized prompts for accurate and structured responses.
5. Use prompt engineering for real-world applications such as chatbots and content generation.
6. Analyze ethical considerations in prompt engineering and responsible AI usage.

UNIT I **(15 Hours)**

Introduction to Prompt Engineering, Importance and Applications of Prompt Engineering, Introduction to LLM, Brief History of Language Models, Basic Structure of Prompts, Five Principles of Prompting, Introducing LLM Prompts, Types of Prompts, Components of an Prompt, Defining Personality in Prompts, Mix and Match Strategic Combination for Enhanced Prompts, Challenges and Limitations of Using Prompts. Introduction to Image Generation with AI, Principles of Designing Prompts for Image Generation, Available Models - OpenAI DALL-E, Midjourney

UNIT II **(15 Hours)**

Prompt Design Techniques: Role-based prompting, Chain-of-thought prompting, Instruction-based prompting, Prompt Optimization Techniques, Improving accuracy, Reducing ambiguity, Controlling output format, Applications of Prompt Engineering, Text generation, Code generation, Content creation, Chatbots, Ethical Considerations in Prompt Engineering, Bias and fairness, Responsible AI usage, Privacy and security, Real-world case studies and examples.

Reference Books:

1. Prompt Engineering for Generative AI. By James Phoenix, Mike Taylor. O'Reilly Media, 2024.
2. AI Engineering by Chip Huyen. O'Reilly Media, 2024.
3. Building AI Applications with ChatGPT APIs. By Valentino Zocca. Packt Publishing, 2023.
4. . Generative AI with Python and PyTorch. By Joseph Babcock Packt Publishing, 2023.
5. Artificial Intelligence Basics: A Non-Technical Introduction. By Tom Taulli. Apress, 2020.

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
VSC-II: Major specific: Basic AI Tools

Course Outcomes:

After completion of this course students will be able to:

1. Identify and use basic Artificial Intelligence tools for performing tasks such as text generation, data analysis, and automation.
2. Apply prompt engineering techniques using AI tools
3. Perform data preprocessing, visualization, and analysis using AI-enabled tools and platforms.
4. Use of AI and Machine Learning platforms such as those provided by Google to build and test basic intelligent models.
5. Evaluate the performance and accuracy of AI tools and interpret the results for decision-making.
6. Develop simple AI-based applications and demonstrate awareness of ethical considerations in using AI tools.

There will be around 25-30 programs based on VSC-II: Major specific: Basic AI Tools

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)

AEC-III: Corporate Culture & Communication

Course Outcomes:

After completion of this course students will be able to:

1. Develop effective professional communication skills
2. Understand organizational and cross-cultural workplace behavior
3. Enhance ethical, digital, and AI-era communication competence.
4. Prepare students for corporate and global work environments.
5. Communicate effectively in professional environments.
6. Draft business documents and reports.

UNIT I

(15 Hours)

Business Communication: Introduction to Business Communication: Meaning and definition of business communication, Objectives and importance in organizations .Types: internal & external communication Role of communication in AI-driven businesses. Communication Process and Models: Elements of communication process , Models of Communication Cycle, Characteristics of Professional communication ,Barriers to communication ,Overcoming communication barriers. Verbal and Non-Verbal Communication: Verbal communication: oral and written Non-verbal communication: body language, kinesics, proxemics, Paralanguage and visual communication –Impact of non-verbal cues in professional settings. Written Business Communication: Principles of effective business writing .Business letters: inquiry, complaint, adjustment, Emails, memos, notices ,Report writing: short reports and summaries AI tools in business writing (email drafting, grammar tools), Oral Communication & Presentation Skills: Meetings: types and conduct ,Interviews: preparation and participation, Public speaking and presentation skills, Use of visual aids and AI presentation tools

UNIT II

(15 Hours)

Business Culture and Professional Ethics: Concept of Culture in Business : Meaning and elements of culture Organizational culture: types and significance, Corporate culture in technology-based organizations, Cultural diversity in the workplace Cross Cultural Communication: High-context and low-context cultures, Hofstede's cultural dimensions Cross-cultural challenges in global business, Communication in multicultural teams ,AI and globalization of workplace communication. Professional Ethics and Corporate Etiquette: Meaning and importance of business ethics, Ethical issues in communication, Corporate etiquette: workplace behavior, dress code , Email, meeting, and virtual etiquette, Ethics in AI communication and data usage. Digital Communication and AI Workplace Culture: Digital communication tools and platforms, Social media communication for business, Remote work culture and virtual collaboration, Impact of AI on organizational communication, Future trends in business communication.

Reference Books:

1. Bovee, C. L. & Thill, J. V. Business Communication Today
2. Lesikar, R. V. Business Communication: Theory and Application
3. Hofstede, G. Cultures and Organizations
4. Guffey, M. E. Business Communication: Process and Product

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM V (Level- 5.5)
OJT

Course Outcomes:

After successful completion of the On-Job Training, students will be able to:

1. Understand the organizational structure, work culture, and professional environment.
2. Apply theoretical knowledge gained during academic study to real-world workplace situations.
3. Develop technical skills relevant to their discipline using industry tools, technologies, and practices.
4. Understand professional skills such as communication, teamwork, time management, and work ethics.
5. Identify and analyze real-world problems and propose appropriate solutions.
6. Develop employability skills and gain practical exposure required for career readiness.

Student has to make a presentation of the work carried out during On Job Training in front of panel external and internal examiners. Student has to submit the report of work carried out as part of On Job Training.

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
Major XI: Natural Language Processing

Course Outcomes:

After completion of this course students will be able to:

1. Understand the concept of natural language processing
2. Explore syntactic analysis.
3. Explore the linguistic features relevant to each NLP task.
4. Understand the phases of Natural language Generation.
5. Apply basic algorithms in this field.
6. Understand architecture of NLG Systems Generation Tasks.

Unit-I

(15 Hours)

Overview And Language Modeling Overview- Origins and challenges of NLP-Language and Grammar-Processing Indian Languages, NLP Applications-Information Retrieval, Language Modeling: Various Grammar - based Language Models - Statistical Language Model. Word Level And Syntactic Analysis: Word Level Analysis - Regular Expressions, Finite-State Automata - Morphological Parsing - Spelling Error Detection and correction - Words and Wordclasses - Part-of Speech Tagging. Syntactic Analysis – Context - free Grammar -Constituency - Parsing – Probabilistic Parsing.

Unit-II

(15 Hours)

Semantic Analysis and Discourse Processing: Semantic Analysis - Meaning Representation, Lexical Semantics, Ambiguity -Word Sense Disambiguation, Discourse Processing, cohesion, Reference Resolution, Discourse Coherence and Structure. Natural Language Generation And Machine Translation: 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.

Reference Books:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, prentice Hall, 2008.
2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin/Cummings publishing company, 1995.

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
Major Practical VI: Computer Vision

Course Outcomes:

After completion of this course students will be able to:

1. Understand the fundamental concepts of digital image processing.
2. Analyze and apply spatial domain image enhancement techniques.
3. Demonstrate the use of frequency domain enhancement techniques
4. Implement and compare image segmentation techniques,
5. Extract and analyze significant image features
6. Design and evaluate object recognition and motion analysis systems

UNIT-I

(15 Hours)

Digital Image fundamentals, Image Sensing and acquisition, Sampling and Quantization, Image formation models, Overview of Computer Vision, Applications of Image processing and Computer Vision, Image enhancement in spatial domain, Basic grey level Transformations, Histogram Processing Techniques, Spatial Filtering, Image smoothing and Image Sharpening, Image enhancement process in frequency domain, Low pass filtering, High pass filtering

UNIT-II

(15 Hours)

Image Segmentation: point, line and edge detection, Thresholding, Regions Based segmentation, Edge linking and boundary detection, Feature Extraction: Importance of Features, Feature extraction techniques, Histogram of Oriented Gradient (HOG), Scale Invariant Feature Transform (SIFT), Background subtraction techniques, Image Matching, Principal Component Analysis (PCA), Object Recognition techniques: Viola-Jones, Yolo, Deep learning algorithms for Object Recognition. Optical Flow, Gaussian Mixture Model (GMM), Structure of Motion, Motion Estimation.

Reference Books:

1. Digital Image Processing- Refael C. Gonzalez and Richard E. Woods, Wesley
2. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision,
by B. K. P. Horn, McGraw-Hill.
3. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
4. Computer Vision, D. H. Ballard, C. M. Brown, Prentice-Hall, Englewood Cliffs

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)

Major Practical VI(a): Natural Language Processing Lab

Course Outcomes:

After completion of this course students will be able to:

1. Implement text preprocessing pipelines including tokenization, stemming and lemmatization
2. Develop and evaluate machine learning models for NLP tasks.
3. Apply word representation techniques including Bag-of-Words, TF-IDF, and word embeddings

There will be around 25-30 programs based on Natural Language Processing Lab

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
Major Practical VI (b): Computer Vision Lab

Course Outcomes:

After completion of this course students will be able to:

1. Design and implement computer vision solutions for image preprocessing and feature extraction,
2. Build and train convolutional neural network (CNN) models for image classification
3. Integrate NLP and Computer Vision models into practical applications

There will be around 25-30 programs based on Computer Vision Lab

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
Major Elective II: Back End Development

Course Outcomes:

After completion of this course students will be able to:

1. Understand NoSQL Fundamentals
2. Develop Proficiency in JSON-Based Data Modeling
3. Apply CRUD Operations in MongoDB
4. Implement Advanced Querying and Indexing Techniques
5. Manage MongoDB Databases and Users
6. Understand Internal Operations and Scalability Features

UNIT-I

(15 Hours)

Introduction to MongoDB (No-sql), Difference between NoSQL and RDBMS, Benefits of NoSQL, Objectives, Design Goals, The Mongo Shell, JSON Introduction, JSON Structure, Collections in MongoDB, Documents In mongoDb, Inserting data into database, Filter queries in Mongoddb Database, Schema Validation in MongoDB database, Indexing In collections, Aggregation in MongoDB, Embedded Document in MongoDB

UNIT-II

(15 Hours)

Inset Documents, Update Documents, Delete Documents, Query Documents, SQL to MongoDB Mapping, MongoDB text search, Partial Updates & Document Limits, Removing Documents, MultiUpdate, Upsert, Wire Protocol, Bulk() Operations and Methods, Common Commands, db.runCommand(), db.isMaster(), db.serverStatus(), db.currentOp(); db.killOp(), collection.stats(), collection.drop() MongoDB Shell, MongoDB Shell, Shell Collection Methods, Cursor Method, MongoDB Database Commands, Query Plan Cache Methods, User Management Method, Role Management Method, MongoDB Replication Methods

Reference Books:

1. MongoDB Basics, by Peter Membrey , David Hows, et al., 2014
2. MongoDB Essentials by Ranjeet Jha, 2025.
3. MongoDB: The Definitive Guide. By Kristina Chodorow. O'Reilly Media, 2019.
4. MongoDB in Action. By Kyle Banker Manning Publications, 2016.
5. MongoDB Fundamentals by Alex Giamas., Packt Publishing, 2019.

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
Major Elective II: Advanced PHP

Course Outcomes:

After completion of this course students will be able to:

1. Design and process dynamic HTML forms using PHP,
2. Develop database-driven web applications by connecting PHP with MySQL
3. Apply Object-Oriented Programming (OOP) concepts in PHP by creating classes, objects, attributes, constructors, destructors, static methods, abstract classes, and inheritance.
4. Implement session and cookie management techniques to maintain state and user authentication
5. Apply error handling and exception handling mechanisms
6. Integrate form handling, database connectivity

UNIT I

(15 Hours)

Handling HTML forms with PHP: HTML forms work, capture form data with PHP, multi value fields, web forms with PHP, storing PHP variables in forms, Creating secure file upload forms, handling file uploads in PHP, validating file types and sizes, working with files and directories (read, write, append, delete), file permissions, Introduction to MySQL databases, Connecting PHP to a MySQL database, PHP CRUD with MYSQL

UNIT II

(15 Hours)

Object Oriented Concepts, Define Class, Class Attributes, Creating an Object, constructors and destructors, Static Method, Abstract Class, Inheritance, Error handling, Exception handling in PHP. Working with sessions and cookies

Reference Books:

1. Matt Doyle, Beginning PHP 5.3, Wiley India Edition, 2012 .
2. PHP6 and MySQL, Steve Suehring, Tim Converse and Joyce Park, Wiley India 2010,
3. Vikram Vaswani, PHP: A Beginners guide, TataMcgraw Hill, 2009
4. Core PHP Programming by Atkinson Leon, Suraski Zeev, Pearson Publication
5. Larry Ullman, PHP 6 and MySQL 5, Pearson Education, 2008.

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
Major Practical II Back End Development Lab

Course Outcomes:

After completion of this course students will be able to:

1. Understand the fundamentals of NoSQL databases and differentiate between relational databases and MongoDB architecture and concepts.
2. Create and manage MongoDB databases, collections, and documents using MongoDB shell commands.
3. Perform database operations such as inserting, updating, deleting, and querying documents in MongoDB.
4. Design efficient MongoDB schemas using embedded documents, schema validation, and indexing techniques.
5. Apply advanced MongoDB features such as aggregation, bulk operations, text search, and query optimization.
6. Manage database administration tasks including user management, role management, replication, and monitoring using MongoDB commands.

There will be around 25-30 programs based on Major Practical II Back End Development Lab

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
Major Practical II Advanced PHP

Course Outcomes:

After completion of this course students will be able to:

1. Design and implement dynamic web forms using PHP to capture, process, and validate user input including file uploads and multi-value fields.
2. Develop PHP programs for file handling operations such as creating, reading, writing, and managing files in web applications.
3. Establish connectivity between PHP and MySQL database and perform CRUD (Create, Read, Update, Delete) operations.
4. Apply Object-Oriented Programming concepts in PHP including classes, objects, constructors, destructors, inheritance, static methods, and abstract classes.
5. Implement session and cookie management techniques for maintaining user state in web applications.
6. Develop robust PHP applications with proper error and exception handling mechanisms for secure and reliable execution.

There will be around 25-30 programs based on Major Practical II Advanced PHP Lab

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
VSC III: Major specific: Advanced AI Tools

Course Outcomes:

After completion of this course students will be able to:

1. Use advanced AI tools and platforms for solving complex tasks such as text generation, image processing, data analysis, and automation.
2. Design effective prompts and workflows using AI platforms such as OpenAI tools to improve accuracy and efficiency of AI-generated results.
3. Develop and deploy intelligent applications using advanced AI and Machine Learning tools such as those provided by Google and other AI platforms.
4. Perform data analysis, visualization, and predictive modeling using AI-powered tools and frameworks.
5. Integrate AI tools with applications for real-time decision-making, automation, and intelligent system development.
6. Evaluate, optimize, and apply AI tools responsibly by considering ethical, security, and performance aspects in real-world applications.

There will be around 25-30 programs based on VSC III: Major specific: Advanced AI Tools

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
SEC III: Cyber Security

Course Outcomes:

After completion of this course students will be able to:

1. Analyze the fundamental concepts of cyber security including confidentiality, integrity, availability, and layers of security.
2. Identify various cyber security threats such as viruses, worms, Trojan horses, ransomware, and identity theft, and understand their impact on systems.
3. Apply security practices for protecting data, mobile devices, browsers, emails, files, and user accounts from cyber threats.
4. Understand cryptography concepts including encryption, decryption, symmetric and asymmetric key cryptography, and digital signatures for secure communication.
5. Describe digital forensics processes, e-commerce security, wireless network security, and firewall mechanisms for protecting digital systems.
6. Demonstrate awareness of cyber crimes, cyber terrorism, security policies, and preventive measures to ensure safe and secure use of digital technologies.

UNIT I

(15 Hours)

Introduction to Cyber Security Cyber Security: Definition, Importance, cyber security fundamentals: confidentiality, Integrity, availability, layers of cyber security, Cyber Warfare-Cyber terrorism-Cyber Espionage, Cyber Hygiene & Security, Cyber Security Vulnerabilities and Cyber Security Safeguards: Cyber Security Vulnerabilities -Overview, vulnerabilities in software, System administration, Weak Authentication, Poor Cyber Security Awareness, Zero Trust Security, Wi-Fi Attacks, Security Threats: Definition, Types of Threats - Virus, Worms, Trojan Horse, Malware, Ransomware, Identity theft etc

UNIT II

(15 Hours)

Cryptography, Symmetric and asymmetric key cryptography, Encryption, Decryption, Digital Signature. Digital forensics, lifecycle of digital forensics, E-commerce Security, dimensions of E-commerce security, Security protocols, Computer Forensics, Wireless Network Security-Components of wireless networks, Security issues in wireless, Wi-Fi Security, Risk of Using Unsecured Wi-Fi, Bluetooth and its security, Firewall, types of firewall. Cyber crime: Introduction, Causes of cyber crime, cyber terrorism.

Reference Books:

1. William Stallings – Cryptography and Network Security, Pearson Education.
2. Nina Godbole and Sunit Belapure – Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India.
3. Charles P. Pfleeger and Shari Lawrence Pfleeger – Security in Computing, Pearson Education.
4. Joseph Migga Kizza – Guide to Computer Network Security, Springer.
5. Eric Maiwald – Fundamentals of Network Security, McGraw-Hill.
6. Atul Kahate – Cryptography and Network Security, Tata McGraw-Hill.

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
AEC IV: Professional Ethics & Corporate Skills

Course Outcomes:

After completion of this course students will be able to:

1. Explain the fundamental concepts of professional ethics, moral values, and codes of conduct relevant to corporate and professional environments.
2. Analyze ethical dilemmas using structured ethical decision-making frameworks, considering bias, empathy, and conflicts of interest.
3. Apply philosophical and psychological approaches to evaluate ethical behavior, integrity, courage, and emotional intelligence in professional life.
4. Assess ethical issues related to research, academics, intellectual property, confidentiality, employee rights, and workplace diversity.
5. Evaluate professional responsibilities related to safety, risk management, environmental protection, and sustainable development.
6. Demonstrate ethical leadership and corporate skills by analyzing CSR and sustainability case studies in national and global business contexts.

UNIT I

(15 Hours)

Foundations of Ethics, Meaning and scope of ethics, Morals, values, and ethics: personal and professional, Individual vs professional ethics, Sense of professional and engineering ethics, Code of professional conduct (with reference to National Society of Professional Engineers), Ethical Decision Making, Ethical dilemmas and moral reasoning, Ethical decision-making models and roadmap, Bias, empathy, and internal obstacles, Conflict of interest and cultural relativism.

UNIT II

(15 Hours)

Business Ethics and Corporate Behaviour, Philosophical approaches to business ethics, Ethical issues in business and organizations, Ethical leadership and corporate governance, Resisting unethical authority and domination, Global business ethics, Psychological and Professional Perspectives, Psychological and philosophical approaches to ethics, Myths about morality, Courage, integrity, emotional intelligence, Ethics in research and academics: academic integrity and intellectual honesty, Ethics in the Workplace, Ethical issues in diverse workplaces, Employee rights, confidentiality, and discrimination, Sustainability and Corporate Skills, Ecology, engineering, and economy, Risk–benefit analysis and risk reduction, Corporate Social Responsibility (CSR), CSR in India and corporate sustainability

Reference Books:

1. Subramanian.R. Professional Ethics, Oxford Publication, 2013.
2. Nagarasan. R.S. Professional Ethics and Human Values. New Age International Publications,
3. Mike W Martin and Roland Schinzingler, Ethics in Engineering, 4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2014

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
IKS: IKS for Computer Science

Course Outcomes:

After completion of this course students will be able to:

1. Explain core concepts and philosophy of Indian Knowledge Systems
2. Relate ancient Indian logic and mathematics to modern computer science
3. Apply IKS-inspired algorithms in computational problem-solving
4. Analyze the role of Sanskrit grammar in NLP and AI
5. Design ethical and sustainable AI systems using IKS principles
6. Evaluate real-world case studies integrating IKS with modern technology

UNIT I

(15 Hours)

Definition and scope of Indian Knowledge Systems, Importance of ancient knowledge in contemporary science and technology, The IKS corpus: Vedas, Upanishads, Smritis, Sutras, Shastras, Objectives, nature, scope, and unique characteristics of IKS, Unique number representation systems: Bhūta Saṃkhya System, Kaṭapayādi System, Pingala's binary system (Laghu–Guru) and its importance in computing, Sanskrit phonetics and linguistics, Panini's Ashtadhyayi, Algorithmic nature of Paninian grammar, Role of Sanskrit in computational linguistics, Morphological analysis and syntax parsing.

UNIT II

(15 Hours)

Applications: POS tagging, Machine translation, AI-driven language models for Indian languages, Knowledge pyramid and epistemology in IKS, Nyaya logic in knowledge representation, Pramana, Prameya, Samsasya as AI reasoning models, Ethical AI inspired by Indian philosophy, Sustainable and socially responsible AI systems Case Studies: Compiler Design, Recursion, Encryption Decryption, Computer Graphics, Algorithm Time Complexity, Binary Combinations, Vedic Mathematics for Signal Processing, Paninian Grammar for NLP and AI language models, Machine Learning inspired by Nyaya Logic

Reference Books:

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. Bhartiya Knowledge Systems by M.C. Bora, Khanna Publishing House
3. Kautilya The Arthashastra. Translated by R. Shamasastri
4. Kapoor, Kapil, and Singh Avadesh Kumar, Indian Knowledge System Vol.1, DK Print World, Ltd., 2005.
5. Mahadevan B., Bhat V R, Nagendra Pavana R.N., Indian Knowledge System Concepts and Application, PHI Learning Pvt. Ltd., 2022.

B.Sc.-M.Sc. Artificial Intelligence & Machine Learning (AI & ML)
Multiple Entry and Multiple Exit Option (NEP-2020)
PART III SEM VI (Level- 5.5)
Field Project

Course Outcomes:

After completion of this course students will be able to:

1. Identify and analyze real-world problems through field investigation or entrepreneurial inquiry.
2. Apply academic knowledge to practical or entrepreneurial contexts.
3. Demonstrate skills in planning, data collection, analysis, and solution development.
4. Develop entrepreneurial mindset and innovation through project-based learning.
5. Exhibit teamwork, leadership, and communication in a real-world setting.
6. Prepare comprehensive project documentation and demonstrate findings through presentation.

Students have to do their project by identified real world problems of society.