Re-Accredited 'B++' 2.86 CGPA by NAAC
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

ક્રમાંક :ઓથો./પરિપત્ર/૯૯૨૯/૨૦૨૬
તા.૦૫/૦૬/૨૦૨૬

પ્રતિ,
વિભાગીય વડાશ્રી,
કોમ્પ્યુટર સાયન્સ વિભાગ,
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી,
સુરત.

વિષયઃ– Master of Science in Artificial Intelligence and Machine Learning (M.Sc. AI / ML) નો સેમેસ્ટર–૧ થી ૪ ના અભ્યાસક્રમ અંગે.

સુજ્ઞશ્રી,

સવિનય જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૬–૨૭ થી ક્રમશઃ અમલમાં આવનાર Master of Science in Artificial Intelligence and Machine Learning (M.Sc. AI / ML) સેમેસ્ટર–૧ થી ૪ નો પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમ કોમ્પ્યુટર સાયન્સ વિષયની અભ્યાસ સમિતિની તા.૨૫/૦૩/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંકઃ૦૬ થી મંજૂર કરી કોમ્પ્યુટર સાયન્સ ફેકલ્ટીને કરેલ ભલામણ કોમ્પ્યુટર સાયન્સ ફેકલ્ટીની તા.૨૯/૦૪/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંકઃ૦૩ થી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા. ૦૭/૦૫/૨૦૨૬ ની સભાનાં ઠરાવ ક્રમાંકઃ૪૬ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

કુલસચિવ(ઇ.ચા.)

પ્રતિ,
(૧) ઈ.ચા.ડીનશ્રી, કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા.
(૨) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારૂ.

M. Sc. (AI & ML)

Veer Narmad South Gujarat University, Surat

About M.Sc. (AI-ML):

The M.Sc. AI (Artificial Intelligence) and ML (Machine Learning) is an exploration to modern and advanced Al and ML concepts and practices on real-world problems. The program will expose the foundations of modern Al along with enough attention to the recent explosion of machine learning techniques such as deep learning, artificial neural network, etc. Students will have a good understanding of the fundamental issues and challenges of machine learning. Students will be able to design and implement various machine learning algorithms in a range of niche real-world applications. This program will make the students understand the strength and weaknesses of many popular machine learning approaches. This program will also impart the knowledge of basic ethical and professional ethics related to the development and application of AI and ML. The program content has the ability to adapt, contribute and innovate new technologies and systems in the key domain of AI and ML. The core knowledge of this program will explore research areas and produce an outstanding contribution in various areas of AI and ML. The students graduating in this program will become expert solution providers and entrepreneurs in the field of Computer Science with Al/ML specialization.

General Information:

Program Name: **M.Sc. (Al-ML)**

Duration of Program: 2 Years (Four Semesters)

Intake: 40

Fees: Rs. 60,000/-per Year (Rs. 30,000/-per Semester) + Examination and University Fees

Admission: On the basis of the Merit of the graduation Marks

Passing Rule: As per the MCA rules of VNSGU

Program Offered By: **Department of Computer Science, Veer Narmad South Gujarat University**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. (AI & ML)

Name of Program	**M. Sc. in Artificial Intelligence and Machine Learning**
Program Abbreviation	**M. Sc. in AI&ML**
Duration	**2 Years**
Eligibility Criteria	Passed BCA/Bachelor's Degree in Computer Science/Engineering or equivalent degree. OR Passed Graduation or Post Graduation with Mathematics or Statistics as a principal subject OR Passed Graduation or Post Graduation in Engineering
Pre-requisite	Basic computer programming skills, basic mathematics and basic statistics
Medium of Instruction	English
Objective of Program	The core objective of the MSC in AI & ML programme is to prepare the students for productive career in AI and ML, Research and academia by providing an outstanding environment for teaching and research in the core and emerging areas of the discipline.
Program Outcome (PO)	**PO1: Fundamental Knowledge Enrichment** Program trains students with the core AI & ML domain. It also makes students capable of using core concepts in the conceptualization of domain specific application development. **PO2: Critical Thinking Development** The program develops the skills of critical thinking, problem solving, evaluative learning of various techniques, and understanding the essence of the problem. **PO3: Advanced Emerging Technology Awareness** The program trains students with the latest technologies that is being used in the AI & ML industry. The continuous syllabi review adds value to the program for the graduating students and make them ready to face challenging demands of the AI & ML industry. **PO4: Advanced Tools Usage** The program teaches the students to apply the advanced tools of AI & ML to solve real world problems. **PO5: Nurturing Research Oriented Approach** The program trains students to develop research oriented approach which will help them to make user centric applications. **PO6: Real World Problem / Project Development** Real world project provides the candidates, exposure to work in the challenging and demanding environment of the industry. The project training makes students employable and industry ready. **PO7: Team Work and Leadership Development** Trains students to work in a team and also to take leadership of the project management team.
Program Specific Outcomes (PSO)	PSO1: Develop and strengthen the fundamental core concepts that are required to solve complex problems. PSO2: Develop the professional and entrepreneurship skills that need independent logical and analytical thinking, teamwork and leadership.

	PSO3: Nurture the students to investigate for the design and development of workable solutions for real word problems. PSO4: Develop students for self-learning and practicing challenging problem solution. PSO5: Train students to use innovative tools and techniques to solve problems in the area of Deep Learning, Machine Learning and Artificial Intelligence. PSO6: To provide a concrete foundation and enrich the abilities of the students to qualify for employment, pursue higher studies and research in the area of AI & ML; with ethical values.
Mapping between POs and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1						
PO2						
PO3						
PO4						
PO5						
PO6						
PO7						

Semester - 3

Course Category TH	Course Code	Course Title	Marksheet Title in English	Level of Course	Teaching Hours/Week		Exam Duration		Credit		Internal Marks		External Marks		Total Marks	
						PR	TH	PR	TH	PR	TH	PR	TH	PR	TH	PR
MAJOR	301	Machine Learning - II	Machine Learning - II	600	4	2			2	2	15	15	35	35	50	50
MAJOR	302	Intelligent IOT with ML	Intelligent IOT with ML	600	4	2			2	2	15	15	35	35	50	50
MAJOR	303	Natural Language Processing	Natural Language Processing	600	4	2			2	2	15	15	35	35	50	50
MAJOR	304	Digital Image Processing	Digital Image Processing	600	4	2			2	2	15	15	35	35	50	50
MINOR	305	Big Data Analytics / Data Mining & Data Warehousing	Big Data Analytics / Data Mining & Data Warehousing	600	4	-			4	-	30	-	70	-	100	-
MINOR	306	AI with IKS	AI with IKS	600	4	-			2	-	30	-	70	-	100	-

Semester - 4

Course Category TH	Course Code	Course Title	Marksheet Title in English	Level of Course	Teaching Hours/Week		Exam Duration		Credit		Internal Marks		External Marks		Total Marks	
						PR	TH	PR	TH	PR	TH	PR	TH	PR	TH	PR
MAJOR	401	Project	Project	600	-	-			-	16		120		280		400
MAJOR	402	Seminar	Seminar	600	-	-			6	-		30		120		150

[Subject code for Theory-2711001703011001]

[Subject code for Practical-2711001703011002]

<table>
<tr><th colspan="7">VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
SYLLABUS</th></tr>
<tr><td>Program Name</td><td colspan="6">Master of Science in Artificial Intelligence and Machine Learning</td></tr>
<tr><td>Semester</td><td colspan="6">3</td></tr>
<tr><td>NCrF Credit Level</td><td colspan="6">6.5</td></tr>
<tr><td>Course Type</td><td colspan="6">Major</td></tr>
<tr><td>Course Subtype</td><td colspan="6">Employability and Skill Development</td></tr>
<tr><td>Subject Type</td><td colspan="6">Discipline Specific</td></tr>
<tr><td>Course Code</td><td colspan="6">301</td></tr>
<tr><td>Course Level</td><td colspan="6">600</td></tr>
<tr><td>Course Title</td><td colspan="6">Machine Learning II</td></tr>
<tr><td>Credit</td><td>Theory:</td><td>2</td><td>Practical:</td><td>2</td><td>Total:</td><td>4</td></tr>
<tr><td>Effective From</td><td colspan="6">Academic Year : 2027-28</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">CO1: Explain the fundamental concepts of Artificial Neural Networks (ANN), including perceptron models, multilayer networks, activation functions, and training mechanisms such as forward and backpropagation.
CO2: Apply deep learning concepts using Keras and TensorFlow to build, preprocess, and train models for regression, binary classification, and multi-class classification problems.
CO3: Design and implement Convolutional Neural Network (CNN) architectures for image representation, feature extraction, classification, and performance evaluation.
CO4: Analyze and implement Recurrent Neural Networks (RNN) and their variants (LSTM and GRU) for sequential data processing, and understand associated training challenges such as vanishing gradients.
CO5: Evaluate and optimize deep learning models using appropriate loss functions, optimizers, performance metrics, and tuning techniques.</td></tr>
<tr><td>Mapping between Cos and PSOs</td><td colspan="6"><table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Course Content</td><td colspan="6">Unit 1: Artificial Neural Network (ANN)
1.1 Concepts of Neurons with reference to the human brain
1.2 Linear Threshold Units
1.3 Perceptron
1.3.1 Representational limitations
1.3.2 Gradient descent training
1.4 Multilayer Networks
1.4.1 Forward Propagation and Backpropagation
1.4.2 Understanding Gradient Descent
1.4.3 Adjusting Weights and Biases
1.4.4 Activation Functions (Binary Step, Linear, Sigmoid, Tanh, ReLU, Leaky ReLU, Softmax)
1.5 Hidden Layers and Intermediate Representations
1.5.1 Distributed Representations</td></tr>
</table>

1.5.2 Overfitting and Underfitting
1.5.3 Learning Network Structure
1.5.4 Introduction to Recurrent Networks

Unit 2: Deep Learning

2.1 Concepts of Deep Learning
2.1.1 Difference between Machine Learning and Deep Learning
2.1.2 Purpose and Applications of Deep Learning
2.2 Libraries for Deep Learning Implementation
2.2.1 Installation and Functions of Keras, Installation and Functions of TensorFlow
2.2.2 Importing Libraries and Modules
2.2.3 Dataset Importing and Preprocessing
2.2.4 Splitting and Feature Scaling of Dataset
2.2.5 Adding Input and Hidden Layers
2.3 Prediction Model with Single Output Node
2.4 Binary Classification Problem (Two Output Nodes)
2.5 Multi-Class Classification (Multiple Output Nodes)

Unit 3: Convolutional Neural Networks (CNN)

3.1 Image Representation
3.1.1 Gray and Color Image Conversion into Arrays and Vectors
3.1.2 Loading Image Dataset
3.2 Keras Methods for Image Processing
3.2.1 Handling 2D and 3D Images
3.2.2 Splitting and Scaling Dataset
3.2.3 Image Augmentation
3.3 Convolution Layers
3.3.1 Feature Detection and Feature Mapping
3.3.2 Applying Activation Functions
3.4 Pooling and Flattening
3.4.1 Types of Pooling (Max, Min, Average)
3.4.2 Flattening Pooled Layers
3.4.3 Generating Tensor for Input Layer
3.5 Model Compilation
3.5.1 Optimizers
3.5.2 Loss Functions and Tuning
3.5.3 Compiling the CNN Model
3.6 CNN Applications and Performance Evaluation
3.6.1 Prediction Models using CNN
3.6.2 Binary and Multi-Class Classification
3.6.3 Model Evaluation and Performance Tuning

Unit 4: Recurrent Neural Networks (RNN)

4.1 Introduction to Sequential Models
4.1.1 Difference between CNN and RNN
4.1.2 Need for RNN in Sequence Data (Text, Time-Series)
4.1.3 Basic Structure and Working of RNN
4.2 Training and Challenges in RNN
4.2.1 Basic Idea of Backpropagation Through Time (BPTT)
4.2.2 Overview of Vanishing Gradient Problem
4.3 Variants of RNN
4.3.1 Introduction to LSTM
4.3.2 Introduction to GRU

Reference Books	1. Horowitz, E., Sahni, S., & Anderson-Freed, S. (2008). *Fundamentals of data structures in C* (2nd ed.). Universities Press. *(Commonly referred to as Ellis Horowitz & Sartaj Sahni Data Structures book)* 2. Rosen, K. H. (2019). *Discrete mathematics and its applications* (8th ed.). McGraw-Hill Education. 3. Brown, M. C. (2018). *Python: The complete reference* (4th ed.). McGraw-Hill Education. 4. Russell, S. J., & Norvig, P. (2021). *Artificial intelligence: A modern approach* (4th ed.). Pearson. 5. Burkov, A. (2019). *The hundred-page machine learning book*. Andriy Burkov. 6. Kosko, B. (1992). *Neural networks and fuzzy systems: A dynamical systems approach to machine intelligence*. Prentice Hall. 7. Flach, P. (2012). *Machine learning: The art and science of algorithms that make sense of data*. Cambridge University Press. 8. Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep learning*. MIT Press. 9. Raschka, S., & Mirjalili, V. (2022). *Python machine learning* (3rd ed.). Packt Publishing. 10. Bishop, C. M. (2006). *Pattern recognition and machine learning*. Springer. 11. Hastie, T., Tibshirani, R., & Friedman, J. (2017). *The elements of statistical learning: Data mining, inference, and prediction* (2nd ed.). Springer. 12. Jurafsky, D., & Martin, J. H. (2023). *Speech and language processing* (3rd ed., draft). Pearson.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment and Practicals
Evaluation Method	Internal Assessment: 30% Marks External Assessment: 70% Marks

[Subject code for Theory-2711001703022001]

[Subject code for Practical-2711001703022002]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
SYLLABUS

Program Name	**Master of Science in Artificial Intelligence and Machine Learning**					
Semester	**3**					
NCrF Credit Level	**6.5**					
Course Type	**Major**					
Course Subtype	**Employability, Skill Development**					
Subject Type	**Emerging Technology**					
Course Code	**302**					
Course Level	**600**					
Course Title	**Intelligent Internet of Things (IoT) with Machine Learning**					
Credit	**Theory:**	**2**	**Practical:**	**2**	**Total:**	**4**
Effective From	**Academic Year : 2027-28**					
Course Outcomes	**CO1:** Explain IoT architecture, communication protocols, and sensor integration. **CO2:** Develop IoT systems using microcontrollers and microcomputers. **CO3:** Perform signal processing, calibration, and data handling for IoT sensors. **CO4:** Apply supervised and unsupervised machine learning techniques on IoT data. **CO5:** Design and implement intelligent IoT-based applications. **CO6:** Evaluate, optimize, and ensure security of IoT systems for real-world deployment and performance improvement.					

Mapping between Cos and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						
CO4						
CO5						
CO6						

Course Content

UNIT 1: IOT FUNDAMENTALS AND SENSOR TECHNOLOGIES

- 1.1 IoT Foundations
  - 1.1.1 IoT Architecture (Perception, Network, Application Layers)
  - 1.1.2 IoT Communication Protocols: MQTT, CoAP, HTTP
  - 1.1.3 Cloud vs Edge in IoT
- 1.2 Iot Components
  - 1.2.1 Introductions to Sensors
  - 1.2.2 Practical usage of Various Sensors
- 1.3 IoT applications

UNIT 2: MICRO CONTROLLER AND SENSOR COMMUNICTAION

	2.1 Introduction to Microcontrollers and Microcomputer: Architecture, Features, and Programming Basics 2.2 Arduino: Development and Programming 2.3 Arduino IDE Setup 2.4 Arduino Pin Diagram 2.5 Introduction to NodeMCU (ESP8266) 2.6 NodeMCU Specifications and Applications 2.7 NodeMCU ESP8266 Pinout 2.8 Interfacing Sensors with Arduino and Node MCU **UNIT 3: IOT DATA ACQUISITION AND MANAGEMENT** 3.1 Analog and Digital Signal Processing 3.2 2 ADC and DAC in IoT 3.3 Sensor Calibration 3.4 Noise Filtering Techniques 3.5 Time-Series IoT Data 3.6 Data Storage (Firebase, SQL) **UNIT 4: MACHINE LEARNING FOR IOT DATA** 4.1 Data Preprocessing 4.2 Handling Missing Data, Feature Engineering, Normalization & Scaling 4.3 Supervised Learning for IoT: Linear Regression (Temperature Prediction), Logistic Regression (Fault Detection), Decision Tree (Smart Classification), Random Forest 4.4 Unsupervised Learning: K-Means (Energy Pattern Clustering), Anomaly Detection
Reference Books	1 Internet of Things: A Hands-on Approach - By Arshdip Bahga and Vijay Madisetti 2 Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow Aurelien Geron 3 Programming Embedded Systems with C and GNU Development tools - By Michael Barr (O'Reilly Publication) 4 Embedded C Coding Standard - By Michael Barr 5 Getting Started with Internet of Things - By Cuno Pfister, O'Reilly 6 Learning Internet of Things - By Peter Waher , Packt Publication 7 IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, Cisco Press 8 Fundamentals of IoT Communication Technologies, Springer 9 Microcontrollers - Architecture, Programming, Interfacing and system design - By Raj Kamal , Pearson 10 Make: Getting Started With Arduino - The Open Source Electronics Prototyping Platform, Shroff/Maker Media 11 ESP8266: Get Started With ESP8266 Programming NodeMCU Using Arduino IDE, Createspace Independent Pub 13 Internet of Things Projects with ESP32, Packt Publishing Limited
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignment and Practicals
Evaluation Method	Internal Assessment: 30% Marks External Assessment: 70% Marks

[Subject code for Theory-2711001703033001]

[Subject code for Practical-2711001703033002]

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<tr><td>Program Name</td><td colspan="6">Master of Science in Artificial Intelligence and Machine Learning</td></tr>
<tr><td>Semester</td><td colspan="6">3</td></tr>
<tr><td>NCrF Credit Level</td><td colspan="6">6.5</td></tr>
<tr><td>Course Type</td><td colspan="6">Major</td></tr>
<tr><td>Course Subtype</td><td colspan="6">Employability and Skill Development</td></tr>
<tr><td>Subject Type</td><td colspan="6">Discipline Specific</td></tr>
<tr><td>Course Code</td><td colspan="6">303</td></tr>
<tr><td>Course Level</td><td colspan="6">600</td></tr>
<tr><td>Course Title</td><td colspan="6">Natural Language Processing</td></tr>
<tr><td>Credit</td><td>Theory:</td><td>2</td><td>Practical:</td><td>2</td><td>Total:</td><td>4</td></tr>
<tr><td>Effective From</td><td colspan="6">Academic Year : 2027-28</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">CO1: To understand fundamental concepts of Natural Language Processing.
CO2: To learn text processing and language representation techniques..
CO3: To apply machine learning and deep learning methods in NLP tasks.
CO4: To develop real-world NLP applications.
CO5: Demonstrate the state-of-the-art algorithms and techniques for text-based processing of natural languages.</td></tr>
<tr><td>Mapping between Cos and PSOs</td><td colspan="6">
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th></tr>
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<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Course Content</td><td colspan="6">Unit 1: Introduction to NLP and Text Processing
1.1. Introduction to NLP and Applications
1.2. Challenges in Natural Language Understanding
1.3. Levels of Language Processing (Morphology, Syntax, Semantics)
1.4. Text Preprocessing Techniques
1.4.1 Tokenization
1.4.2 Stop word removal
1.4.3 Stemming and Lemmatisation
1.5. Regular Expressions
1.6. Corpus and Dataset Preparation

Unit 2: Text Representation and Language Modeling
2.1 Bag of Words Model
2.2 TF–IDF Representation
2.3 N-Gram Language Models
2.4 Probabilistic Language Models
2.5 Word Embeddings
2.5.1 Word2Vec
2.5.2 GloVe
2.6 Evaluation of Language Models</td></tr>
</table>

	Unit 3: NLP using Machine Learning 3.1 Part of Speech (POS) Tagging 3.2 Named Entity Recognition (NER) 3.3 Text Classification 3.4 Sentiment Analysis 3.5 Feature Extraction Techniques 3.6 Machine Learning Algorithms for NLP 3.6.1 Naïve Bayes 3.6.2 Logistic Regression 3.6.3 Support Vector Machine **Unit 4: Deep Learning and Advanced NLP** 4.1 Recurrent Neural Networks (RNN) 4.2 LSTM and GRU 4.3 Attention Mechanism and Transformers 4.4 Pretrained Models (BERT – Overview) 4.5 Applications: 4.5.1 Machine Translation 4.5.2 Text Summarization 4.5.3 Chatbots and Question Answering Systems 4.6 Ethical Issues in NLP
Reference Books	1. Speech and Language Processing , An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Daniel Jurafsky and James H. Martin, Pearson 2. Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit, Steven Bird, Ewan Klein, and Edward Loper, Shroff Publisher & Distributors Pvt. Ltd. 3. The Handbook of Computational Linguistics and Natural Language Processing, Alexander Clark, Chris Fox, Shalom Lappin, Wiley-Blackwell 4. Natural Language Processing and Text Mining, annekao, Springer 5. Natural Language Processing and Information Systems, Helmut Horacek, Springer.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignments and Practicals
Evaluation Method	Internal Assessment: 30% Marks External Assessment: 70% Marks

[Subject code for Theory-2711001703044001]

[Subject code for Practical-2711001703044002]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
SYLLABUS

Program Name	**Master of Science in Artificial Intelligence and Machine Learning**					
Semester	**3**					
NCrF Credit Level	**6.5**					
Course Type	**Major**					
Course Subtype	**Employability and Skill Development**					
Subject Type	**Discipline Specific**					
Course Code	**304**					
Course Level	**600**					
Course Title	**Digital Image Processing**					
Credit	**Theory:**	**2**	**Practical:**	**2**	**Total:**	**4**
Effective From	**Academic Year : 2027-28**					

Course Outcomes

CO1: Explain students the fundamental aspects of Image processing, the concept of image formation, digitization and the role human visual system plays in perception of image data.

CO2: Train students to use various Libraries to perform different operations related to image processing like image transformation, image enhancement, segmentation etc.

CO3: Explain and train students to work with various phases of Natural language processing by making them practically work on them.

CO4: Analyze and implement image processing algorithms for various real-time applications using artificial intelligence and deep learning.

CO5: Demonstrate the state-of-the-art algorithms and techniques for text-based processing of natural languages.

Mapping between Cos and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	■			■		
CO2	■	■		■	■	
CO3	■	■	■	■	■	
CO4	■	■	■	■	■	■
CO5	■	■	■	■	■	■

Course Content

Unit – 1 Introduction to Image Processing & Image Enhancement

1.1 Image Fundamentals
1.2 Elements of the Image Processing System
1.3 Applications of Digital Image Processing
1.4 Image Transformation
1.5 Histogram processing
1.6 Spatial & Frequency Domain Methods
- 1.6.1 Image Smoothing
- 1.6.2 Image Sharpening
- 1.6.3 Selective Filtering

Unit – 2 Image Restoration

2.1 Image degradation
2.2 Types of Image Blur
2.3 Restoration in the presence of noise–only spatial filtering
- 2.3.1 Weiner filtering

	2.3.2 Constrained least squares filtering 2.3.3 Geometric transforms 2.3.4 Introduction to the Fourier transform **Unit – 3 Image Segmentation** 3.1 Feature Extraction: pint, line and edge detection 3.2 Region base segmentation techniques 3.2.1 Classification of segmentation techniques 3.2.2 Region approach to segmentation 3.2.3 Clustering technique 3.3 Image segmentation based on thresholding 3.4 Edge based segmentation 3.4.1 Edge detection and linking 3.4.2 Hough Transformation 3.4.3 Active Contour Image **Unit – 4 Image Recognition** 4.1Patterns and Pattern Classes 4.1.1 Pattern definition 4.1.2 Feature vectors 4.1.3 Pattern classes and boundaries 4.2 Recognition based on Decision-Theoretic Methods 4.2.1 Bayesian Decision Theory 4.2.2 Minimum distance classifier 4.2.3 Maximum likelihood estimation 4.3 Object Detection and Feature Description 4.3.1 Structural Methods 4.3.2 Feature Descriptors (HOG, SIFT, ORB) 4.3.3 Object Detection (YOLO, R-CNN, SSD) 4.3.4 Face Recognition (Eigenfaces, FaceNet)
Reference Books	1. Digital Image processing, R. C.Gonzalez, R.E.Woods, Pearson edition 2. Fundamentals of Digital Image Processing, A.K.Jain,PHI 3. Digital Image Processing, Pratt W.K., John Wiley 4. Image Processing , Analysis & Machine Vision, Milan Sonka, Thomson Publication 5. Digital Signal Processing: Principles, Algorithms, and Applications, John G. Proakis, Dimitris and G.Manolakis, Pearson Education 6. Computer Vision and Image Processing, Adrian Low, Second Edition, B.S.Publications 7. Digital Image Processing, Rafeal C.Gonzalez, Richard E.Woods, Second Edition, Pearson Education/PHI.
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignments and Practicals
Evaluation Method	Internal Assessment: 30% Marks External Assessment: 70% Marks

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
SYLLABUS

Program Name	**Master of Science in Artificial Intelligence and Machine Learning**					
Semester	**3**					
NCrF Credit Level	**6.5**					
Course Type	**Minor**					
Course Subtype	**Employability and Skill Development**					
Subject Type	**Discipline Specific**					
Course Code	**305**					
Course Level	**600**					
Course Title	**Big Data Analytics**					
Credit	**Theory:**	**4**	**Practical:**		**Total:**	**4**
Effective From	**Academic Year : 2027-28**					

Course Outcomes

CO1: Explain Big Data concepts, types, characteristics (Volume, Variety, Velocity, Variability), and advantages.
CO2: Describe Big Data Analytics evolution, architecture, tools, and implementation challenges.
CO3: Demonstrate understanding of NoSQL databases and perform CRUD operations, indexing, and aggregations using MongoDB.
CO4: Explain Hadoop architecture, HDFS components, commands, and MapReduce processing model.
CO5: Apply HiveQL for querying large datasets and design schema using HBase with indexing techniques.

Mapping between Cos and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						
CO4						
CO5						

Course Content

Unit 1: Introduction to Big Data and Big Data Analytics
- 1.1 Big Data
- 1.2 Importance of Big Data
- 1.3 Types of Big Data
  - 1.3.1 Structured
  - 1.3.2 Unstructured
  - 1.3.3 Semi-Structured
- 1.4 Characteristics of Big Data
  - 1.4.1 Volume
  - 1.4.2 Variety
  - 1.4.3 Velocity
  - 1.4.4 Variability
- 1.5 Advantages of Big Data
- 1.6 Big Data Analytics
  - 1.6.1 History and Evolution of Big Data Analytics
  - 1.6.2 Importance of Big Data Analytics
  - 1.6.3 Typical Analytical Architecture
  - 1.6.4 Challenges in Big Data Analytics

	1.6.5 Big Data Analytics Tools and Technology Unit 2: NoSQL Databases and MongoDB 2.1 Introduction to NoSQL 2.2 Advantages and Disadvantages of NoSQL 2.3 Types of NoSQL Databases 2.4 MongoDB 2.4.1 MongoDB Architecture 2.4.2 Documents and Collections 2.4.3 Queries 2.4.3.1 Simple Queries 2.4.3.2 Complex Queries (Existential Field Values, Aggregations and Groups) 2.4.4 Updates and Deletes 2.4.5 Indexing 2.4.6 MongoDB RESTful API 2.5 NoSQL in Cloud Unit 3: Hadoop and HDFS 3.1 Hadoop Overview 3.2 Hadoop Architecture 3.3 Hadoop Ecosystem Components 3.4 Hadoop Cluster Introduction 3.5 HDFS Overview 3.6 Characteristics of HDFS 3.7 HDFS Architecture and Components 3.8 HDFS Commands 3.9 Introduction to MapReduce Unit 4: Hive and HBase 4.1 Hive 4.1.1 Hive Introduction 4.1.2 Hive Architecture 4.1.3 Hive vs RDBMS 4.1.4 HiveQL Querying Data 4.2 HBase 4.2.1 HBase Concepts 4.2.2 Advanced Usage 4.2.3 Schema Design 4.2.4 Advanced Indexing
Reference Books	1. Chris Eaton,Dirkderooset al. , “Understanding Big data ”, McGraw Hill 2. BIG Data and Analytics , Sima Acharya, Subhashini Chhellappan, Willey 3. Alex Holmes, Hadoop in Practice, Manning Publication 4. Tom White, Hadoop The Definitive Guide, o’Reilly 5. Kristina Chodorow, MongoDB Definitive Guide 2e, O’Reilly 6 Amol Nayak, Instant MongoDB, Packt Publishing Limited 7. Hu, Wen Chen, Big Data Management, Technologies and Applications, IGI Global
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignments and Practicals
Evaluation Method	Internal Assessment: 30% Marks External Assessment: 70% Marks

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	**Master of Science in Artificial Intelligence and Machine Learning**					
Semester	**3**					
NCrF Credit Level	**6.5**					
Course Type	**Minor**					
Course Subtype	**Employability and Skill Development**					
Subject Type	**Discipline Specific**					
Course Code	**305**					
Course Level	**600**					
Course Title	**Data Warehousing and Data Mining**					
Credit	**Theory:**	**4**	**Practical:**		**Total:**	**4**
Effective From	**Academic Year : 2027-28**					

Course Outcomes

CO1: Explain data warehouse concepts, OLTP vs OLAP systems, multidimensional models, and data preprocessing techniques.
CO2: Apply frequent pattern mining techniques such as Apriori and FP-Growth for association rule generation.
CO3: Implement classification and prediction models including Decision Tree, Regression, and Naïve Bayes.
CO4: Apply clustering techniques such as k-Means and hierarchical clustering for data analysis.
CO5: Analyze real-world applications and trends in data mining for knowledge discovery.

Mapping between Cos and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	■					■
CO2	■	■			■	
CO3	■	■	■		■	■
CO4	■	■	■	■	■	■
CO5	■	■	■	■		■

Course Content

Unit 1: Data Warehousing and Data Pre-processing
- 1.1 Data Warehouse
  - 1.1.1 Introduction to Data Warehouse
  - 1.1.2 Data Warehouse Characteristics
  - 1.1.3 Data Marts
  - 1.1.4 OLTP and OLAP Systems
  - 1.1.5 Star, Snowflake, and Fact Constellation Schemas for Multidimensional Databases
  - 1.1.6 OLAP Operations in the Multidimensional Data Model
  - 1.1.7 Types of OLAP Servers
  - 1.1.8 Developing a Data Warehouse
  - 1.1.9 Building a Data Warehouse
  - 1.1.10 Three-Tier Data Warehouse Architecture
  - 1.1.11 Metadata Repository
- 1.2 Data Pre-processing
  - 1.2.1 Descriptive Data Summarization

	1.2.1.1 Central Tendency 1.2.1.2 Dispersion of Data 1.2.2 Data Cleaning 1.2.2.1 Missing Values 1.2.2.2 Noisy Data 1.2.3 Data Integration and Transformation 1.2.4 Data Reduction 1.2.4.1 Attribute Selection 1.2.5 Data Discretization and Concept Hierarchy Generation Unit 2: Introduction to Data Mining and Frequent Pattern Mining 2.1 Introduction to Data Mining 2.2 Knowledge Discovery and Data Mining 2.3 Data Mining Functionalities 2.3.1 Concept/Class Description 2.3.1.1 Characterization 2.3.1.2 Discrimination 2.3.2 Mining Frequent Patterns, Associations, and Correlations 2.3.3 Classification and Prediction 2.3.4 Cluster Analysis 2.3.5 Outlier Analysis 2.3.6 Evolution Analysis 2.4 Mining Frequent Patterns, Associations, and Correlations 2.4.1 Basic Concepts 2.4.1.1 Frequent Itemsets 2.4.1.2 Closed Itemsets 2.4.1.3 Association Rules 2.4.2 Apriori Algorithm 2.4.2.1 Candidate Generation Method 2.4.3 FP-Growth Algorithm 2.4.4 Generating Association Rules 2.4.5 Multilevel and Multidimensional Association Rules Unit 3: Classification and Prediction 3.1 Introduction to Classification and Prediction 3.2 Prediction Techniques 3.2.1 Linear Regression 3.2.2 Nonlinear Regression 3.3 Decision Tree Algorithm 3.3.1 Decision Tree Induction 3.3.2 Attribute Selection Measures 3.3.2.1 Information Gain 3.3.2.2 Gain Ratio 3.3.3 Tree Pruning 3.4 Bayesian Classification 3.4.1 Bayes' Theorem 3.4.2 Naïve Bayesian Classification 3.5 Accuracy and Error Measures for Classification Unit IV: Cluster Analysis and Applications of Data Mining 4.1 Classification vs Clustering 4.2 Partitioning Methods 4.3 Hierarchical Clustering Methods 4.4 Classical Partitioning Method: k-Means 4.5 Applications and Trends in Data Mining
Reference Books	1. The Data Warehouse Toolkit – Ralph Kimball & Margy Ross, Wiley publication 2. Data Mining: Concepts and Techniques – Jiawei Han & Micheline Kamber

	3. Data Warehousing, Data Mining & OLAP – Alex Berson & Stephen Smith 4. Data Warehousing & Data Mining – Varsha Bhosale & Deepali Vora, Dreamtech Press 5. Data Mining and Warehousing – M. Sudheep Elayidom , Cengage India 6. Data Warehousing and Data Mining – Deepali Kamthania, IK International 7. Data Warehousing and Mining – Manish Pandey & Rakesh Kumar
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignments and Practicals
Evaluation Method	Internal Assessment: 30% Marks External Assessment: 70% Marks

[Subject code-2711001703066001]

<table>
<tr><td colspan="7">VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
SYLLABUS</td></tr>
<tr><td>Program Name</td><td colspan="6">Master of Science in Artificial Intelligence and Machine Learning</td></tr>
<tr><td>Semester</td><td colspan="6">3</td></tr>
<tr><td>NCrF Credit Level</td><td colspan="6">6.5</td></tr>
<tr><td>Course Type</td><td colspan="6">Minor</td></tr>
<tr><td>Course Subtype</td><td colspan="6">Employability and Skill Development</td></tr>
<tr><td>Subject Type</td><td colspan="6">Intra-disciplinary</td></tr>
<tr><td>Course Code</td><td colspan="6">306</td></tr>
<tr><td>Course Level</td><td colspan="6">600</td></tr>
<tr><td>Course Title</td><td colspan="6">AI & Indian Knowledge System (IKS)</td></tr>
<tr><td>Credit</td><td>Theory:</td><td>2</td><td>Practical:</td><td>0</td><td>Total:</td><td>2</td></tr>
<tr><td>Effective From</td><td colspan="6">Academic Year : 2027-28</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">CO1: Explain fundamental concepts of IKS and Indian philosophical logic.
CO2: Relate Indian mathematical and logical systems with computational thinking.
CO3: Compare Indian cognitive models with modern AI/ML frameworks.
CO4: Apply ethical principles from IKS in AI system design.</td></tr>
<tr><td>Mapping between Cos and PSOs</td><td colspan="6">
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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</td></tr>
<tr><td>Course Content</td><td colspan="6">Unit 1: Foundations of Indian Knowledge System
1.1 Introduction to Indian Knowledge System
1.1.1 Meaning, Scope and Importance of IKS
1.1.2 Evolution of Indian Knowledge Traditions
1.1.3 Interdisciplinary Nature of IKS
1.2 Knowledge Framework in Indian Philosophy
1.2.1 Pramana (Means of Knowledge)
1.2.1.1 Pratyaksha (Perception)
1.2.1.2 Anumana (Inference)
1.2.1.3 Upamana (Comparison)
1.2.1.4 Shabda (Testimony)
1.2.2 Logic in Nyaya System
1.2.3 Concept of Consciousness in Vedanta
1.3 Ethics and Values in Indian Thought
1.3.1 Dharma and Responsibility
1.3.2 Ethical Decision Making
1.3.3 Relevance to AI Ethics

Unit 2: Indian Mathematics, Logic and Computational Thinking
2.1 Indian Contributions to Mathematics
2.1.1 Concept of Zero and Decimal System
2.1.2 Algebra and Trigonometry
2.1.3 Combinatorics in Ancient Texts</td></tr>
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	2.2 Indian Logic Systems 2.2.1 Nyaya Logic Structure 2.2.2 Five-membered Syllogism 2.2.3 Comparison with Modern Logical Systems 2.3 Computational Thinking in Ancient India 2.3.1 Panini's Grammar as Rule-Based System 2.3.2 Algorithmic Thinking in Sanskrit Grammar 2.3.3 Relevance to Natural Language Processing (NLP) Unit 3: Knowledge Representation and AI Perspectives 3.1 Knowledge Representation in Indian Traditions 3.1.1 Ontology in Indian Philosophy 3.1.2 Categorization Systems (Padartha) 3.1.3 Symbolic Representation 3.2 Indian Approaches to Cognition 3.2.1 Mind (Manas), Intellect (Buddhi), Consciousness (Chitta) 3.2.2 Learning and Memory Concepts 3.2.3 Comparison with Machine Learning Models 3.3 Ayurveda and Systems Thinking 3.3.1 Data-driven Diagnosis in Ayurveda 3.3.2 Pattern Recognition Concepts 3.3 Predictive Models in Traditional Knowledge Unit 4: Applications of IKS in Modern AI & ML 4.1 AI Ethics from an Indian Perspective 4.1.1 Responsible AI 4.1.2 Bias and Fairness 4.1.3 Human-centred AI 4.2 Indian Knowledge and Sustainable Technologies 4.2.1 Ecological Intelligence 4.2.2 Holistic System Design
Reference Books	1. Indian Knowledge System — Kapil Kapoor 2. An Introduction to Indian Philosophy — Chatterjee & Datta 3. Artificial Intelligence: A Modern Approach — Russell & Norvig 4. The Crest of the Peacock — G. G. Joseph 5. Ethics of Artificial Intelligence — Oxford Handbook
Teaching Methodology	Class work, Discussion, Self-Study, Seminars and/or Assignments and Practicals
Evaluation Method	Internal Assessment: 30% Marks External Assessment: 70% Marks

[Subject code-2811001704011001**]**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT SYLLABUS						
Program Name	**Master of Science in Artificial Intelligence and Machine Learning**					
Semester	**4**					
NCrF Credit Level	**6.5**					
Course Type	**Internship**					
Course Subtype	**Employability & Skill Development**					
Subject Type	**Discipline Specific**					
Course Code	**401**					
Course Level	**600**					
Course Title	**Project**					
Credit	**Theory:**		**Practical:**	**16**	**Total:**	**16**
Effective From	**Academic Year : 2027-28**					
	● At the end of the semester, the students have to submit the project reports in bounded form to the institution. ● Project completion certificate issued by the institute is mandatory for appearing in project presentation and viva - Voce. ● The project presentation and viva-Voce will be conducted as per the university exam schedule. ● Workload for teachers: Guiding 4 students as an internal guide for project work will considered as 1- hr. workload per week.					
Evaluation Method	Internal Assessment : __120___ Marks External Assessment : __280___ Marks					

[**Subject code-***2811001704022001*]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT SYLLABUS						
Program Name	**Master of Science in Artificial Intelligence and Machine Learning**					
Semester	**4**					
NCrF Credit Level	**6.5**					
Course Type	**Major**					
Course Subtype	**Skill Development**					
Subject Type	**Discipline Specific**					
Course Code	**402**					
Course Level	**600**					
Course Title	**Seminar**					
Credit	**Theory:**	**6**	**Practical:**		**Total:**	**6**
Effective From	**Academic Year : 2027-28**					
	● The students are required to prepare a seminar on a relevant topic concerning the subject of interest of the student; as well as latest technology. ● The students must prepare documentation of the seminar. ● At the end of the semester, the students have to submit the seminar reports in spiral bounded form to the institution. ● Seminar Completion Certificate issued by the institute is mandatory for appearing in Seminar Presentations. ● The Seminar Presentation will be conducted as per the University exam schedule. ● The students have to submit the following reports at the institution: 1. Seminar Topic Chosen 2. Institution Certificate for Seminar					
Evaluation Method	Internal Assessment: __30___ Marks External Assessment: _120___ Marks					