

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May – 2026**COMPUTER VISION AND IMAGE PROCESSING**

(CSE- Artificial Intelligence)

Time: 3Hrs

Max Marks: 70

Attempt all the questions. All parts of the question must be answered in one place only.

All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S.No.	Question	Marks	CO	BL
1.	i) What is an image?	1	1	1
	ii) Define digital image and analog image.	1	1	1
	iii) Define feature extraction.	1	2	1
	iv) What is Hessian matrix?	1	2	1
	v) Define stereo vision technique.	1	3	1
	vi) What is high and low disparity?	1	3	1
	vii) Define binary classification.	1	4	1
	viii) What is Non-Maximum Suppression (NMS)?	1	4	1
	ix) List any two applications used in Virtual Reality.	1	5	1
	x) What is role of face recognition in surveillance system?	1	5	1
2(A)	(i) Explain the fundamental steps of digital image processing with a neat diagram.	6	1	2
	(ii) Discuss the importance of histogram equalization technique to find the equalized image with an example.	6	1	2
OR				
2(B)	Illustrate the methods of linear and non-linear spatial filtering used in image processing with examples.	12	1	2
3(A)	Apply the SIFT algorithm to extract features on the following			
	(i) 3×3 gray scale patch $I = \begin{bmatrix} 10 & 30 & 40 \\ 30 & 40 & 50 \\ 40 & 50 & 60 \end{bmatrix}$	6	2	3
	Demonstrate thresholding-based segmentation on the following			
3(B)	(ii) image $I = \begin{bmatrix} 90 & 120 & 50 \\ 60 & 80 & 150 \\ 40 & 150 & 160 \end{bmatrix}$, threshold value $T = 100$	6	2	3
OR				
3(B)	Construct the region response (R) by using SURF feature extraction technique on the below Integral image (I) and then compute the Hessian matrix at the center pixel (1,1) using second order derivatives.	12	2	3
$I = \begin{bmatrix} 20 & 30 & 40 \\ 30 & 40 & 90 \\ 90 & 100 & 120 \end{bmatrix}$				
4(A)	Examine the sum of squared differences (SSD) based on the below values.			
	(i) Left Block = $\begin{bmatrix} 10 & 20 & 30 \\ 20 & 30 & 40 \\ 30 & 40 & 60 \end{bmatrix}$ and Right Block = $\begin{bmatrix} 22 & 32 & 30 \\ 30 & 33 & 44 \\ 35 & 42 & 52 \end{bmatrix}$	6	3	4
	(ii) Interpret the need of quadratic motion between the two frames (frame-1 and frame-2) by using the Farneback method on the	6	3	4

following polynomial coefficients. $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$, $b_1 = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$ and

$$b_2 = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

OR

Analyze optical flow constraint equation (OFCE) by using the Lucas-Kanade problem on the below 3×3 window gradients to estimate u and v directions.

4(B)

Pixel	I_x	I_y	I_t
P1	2	1	-1
P2	1	2	-2
P3	1	2	-2

12

3

4

- (i) Solve Normalized Cross-Correlation (NCC) for the patch $A=[10,50,80]$, $B=[30,50,80]$

6

4

3

5(A)

- (ii) Apply the CNN steps in object detection by considering your own example with constraints:
 $I(6 \times 6)$, $K = 2 \times 2$, $S = 1$ and $bias = 13$

6

4

3

OR

Demonstrate the need of R-CNN family in object detection and calculate the Intersection over Union (IoU) metric for the following:

5(B)

12

4

3

- Ground Truth Box (B_{gt}) = [14, 14, 20, 20]
- Predicted Box (B_p) = [10, 10, 8, 10]

6(A)

Interpret the Content-Based Image Retrieval (CBIR) architecture with its applications.

12

5

4

OR

6(B)

Determine the role of medical imaging workflow and its applications in computer vision.

12

5

4

*****END*****

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May – 2026**NATURAL LANGUAGE PROCESSING**

(CSE – Artificial Intelligence)

Time: 3Hrs**Max Marks: 70**

Attempt all the questions. All parts of the question must be answered in one place only.
All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S.No.	Question	Marks	CO	BL
1.	i) What is morphological parsing in NLP?	1	1	1
	ii) Define bigram language model.	1	1	1
	iii) What is transformation-based POS tagging?	1	2	1
	iv) Define treebank in syntactic analysis.	1	2	1
	v) What is sentiment analysis?	1	3	1
	vi) What is an inverted index in information retrieval?	1	3	1
	vii) What are MT evaluation metrics? Name any two.	1	4	1
	viii) Define selectional restrictions in semantics.	1	4	1
	ix) What is digital signal processing in speech analysis?	1	5	1
	x) Define phonetics and its relevance to speech processing.	1	5	1
2(A)	(i) Explain Regular Expressions and Finite-State Automata with suitable examples from text processing.	6	1	2
	(ii) Describe the process of Minimum Edit Distance computation. How is it applied in spelling error correction?	6	1	3
OR				
2(B)	Explain the N-gram language model in detail. How are smoothing techniques applied to handle unseen N-grams? Illustrate with examples.	12	1	2
3(A)	(i) Describe top-down and bottom-up parsing strategies. Illustrate with an example grammar.	6	2	2
	(ii) Explain Feature Structures and the Unification operation in feature-based grammars with examples.	6	2	2
OR				
3(B)	Explain POS Tagging using Hidden Markov Models (HMM). Describe the Viterbi algorithm with a step-by-step example.	12	2	2
4(A)	(i) Explain the LSTM-based information retrieval model. How does it differ from classical IR models?	6	3	2
	(ii) Describe the Fuzzy Set model for information retrieval. How is uncertainty handled in query matching?	6	3	2
OR				
4(B)	Explain about the supervised and dictionary-based approaches to Word Sense Disambiguation. Compare their effectiveness with examples.	12	3	3
5(A)	(i) Explain First-Order Logic (FOL) in semantic analysis. How is it used to represent sentence meaning in NLP?	6	4	2
	(ii) Describe word senses and relations between senses (synonymy, antonymy, hyponymy). How are they used in NLP applications?	6	4	2

OR

5(B)	Explain semantic role labelling (SRL) using thematic roles. How do selectional restrictions contribute to accurate semantic interpretation in NLP?	12	4	2
6(A)	(i) Explain the process of feature extraction using Mel-Frequency Cepstral Coefficients (MFCC). What are its steps and applications?	6	5	2
	(ii) Describe the role of Hidden Markov Models (HMMs) in speech recognition. How are emission and transition probabilities used?	6	5	2
OR				
6(B)	Describe how an analog speech signal is digitized and processed. Explain sampling, quantization, and windowing in the context of speech analysis.	12	5	2

*****END*****

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE
(UGC-AUTONOMOUS INSTITUTION)**B. Tech III Year II Semester (R23) Regular End Semester Examinations, May – 2026****EXPLORATORY DATA ANALYSIS WITH PYTHON**

(CSE – Artificial Intelligence)

Time: 3Hrs**Max Marks: 70**

Attempt all the questions. All parts of the question must be answered in one place only.
All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S.No.	Question	Marks	CO	BL
1.	i) Mention any two applications of Data Science.	1	1	1
	ii) What is the use of df.info ()?	1	1	1
	iii) How is the interquartile range (IQR) calculated from a dataset?	1	2	1
	iv) How does categorical data differ from numerical data?	1	2	1
	v) What is Univariate Analysis?	1	3	1
	vi) Define Covariance.	1	3	1
	vii) Interpret the purpose of customizing plots.	1	4	2
	viii) How does data visualization help in understanding data?	1	4	1
	ix) Which tool is commonly used to create EDA reports in Python?	1	5	2
	x) Why is data preprocessing important before machine learning?	1	5	1
2(A)	Explain the importance of Exploratory Data Analysis (EDA) in the Data Science Life Cycle with suitable examples.	12	1	2
OR				
2(B)	Demonstrate a Python program using Pandas Series to perform basic operations.	12	1	2
3(A)	(i) Apply Min-Max scaling to normalize data within a specific range.	6	2	3
	(ii) Apply standardization using Z-score scaling on the same dataset.	6	2	3
OR				
3(B)	(i) Apply label encoding to convert categorical data into numerical form using Python.	6	2	3
	(ii) Identify one-hot encoding to the same dataset using Python.	6	2	3
4(A)	(i) Apply Seaborn's pairplot() function by writing a Python program to visualize relationships among variables in any dataset.	6	3	3
	(ii) Apply the bar chart technique for a dataset to construct horizontal bar plots, stacked bar plots and interpret the information represented.	6	3	3
OR				
4(B)	Discuss the concept of histograms to represent the data and identify whether it is normal, skewed, bimodal or uniform.	12	3	3
5(A)	(i) Explain how subplots and single plots differ in improving analytical understanding, using a suitable Python example.	6	4	2
	(ii) Evaluate the features of Plotly for interactive visualization.	6	4	4
OR				
5(B)	Analyze the differences between Matplotlib and Seaborn in terms of features, complexity and visualization capabilities.	12	4	4
6(A)	(i) Justify the importance of data preparation steps in improving model performance.	6	5	5
	(ii) Explain different outlier detection techniques (Z-score, IQR, box plot).	6	5	2
OR				
6(B)	Create a complete EDA workflow for the Titanic dataset including data cleaning, visualization and interpretation.	12	5	6

*****END*****

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE
(UGC-AUTONOMOUS INSTITUTION)**B. Tech III Year II Semester (R23) Regular End Semester Examinations, May – 2026****RECOMMENDER SYSTEMS**

(CSE - Artificial Intelligence)

Time: 3Hrs**Max Marks: 70**

Attempt all the questions. All parts of the question must be answered in one place only.
All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S.No.	Question	Marks	CO	BL																														
1.	i) List types of recommender systems.	1	1	1																														
	ii) Name the function of recommender system with an example.	1	1	1																														
	iii) List the challenges posted by cold start problem.	1	2	1																														
	iv) What is cosine similarity?	1	2	1																														
	v) What is content-based filtering based on item features?	1	3	1																														
	vi) Define feature vector.	1	3	1																														
	vii) What is the importance of feature extraction in content-based filtering?	1	4	1																														
	viii) What are the challenges of using SVD in recommender systems?	1	4	2																														
	ix) What is F1-score?	1	5	1																														
	x) Give examples of large-scale recommender systems.	1	5	2																														
2(A)	(i) Explain hybrid recommender systems with an example	6	1	2																														
	(ii) List applications of recommender systems in detail.	6	1	1																														
OR																																		
2(B)	Summarize the role of data sources (explicit and implicit feedback) in recommendations.	12	1	2																														
3(A)	(i) Illustrate the techniques to handle cold-start issues.	6	2	3																														
	(ii) Explain Jaccard similarity and compare it with Pearson	6	2	2																														
OR																																		
3(B)	We have a user-item rating matrix for a movie recommender system, where users rate movies on a scale of 1 to 5. The matrix below shows the ratings provided by four users for five different movies: <table><tr><td>User/Movie</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td></tr><tr><td>User1</td><td>4</td><td>5</td><td>3</td><td>NaN</td><td>2</td></tr><tr><td>User 2</td><td>5</td><td>3</td><td>4</td><td>2</td><td>1</td></tr><tr><td>User 3</td><td>2</td><td>NaN</td><td>5</td><td>4</td><td>3</td></tr><tr><td>User 4</td><td>NaN</td><td>4</td><td>3</td><td>5</td><td>4</td></tr></table> Using KNN algorithm use similarity matrix and derive the ratings of movies.	User/Movie	A	B	C	D	E	User1	4	5	3	NaN	2	User 2	5	3	4	2	1	User 3	2	NaN	5	4	3	User 4	NaN	4	3	5	4	12	2	4
User/Movie	A	B	C	D	E																													
User1	4	5	3	NaN	2																													
User 2	5	3	4	2	1																													
User 3	2	NaN	5	4	3																													
User 4	NaN	4	3	5	4																													
4(A)	What are the advantages and limitations of content-based filtering compared to collaborative filtering? Discuss the situations in which content-based filtering is more effective.	12	3	4																														
OR																																		
4(B)	(i) Apply item feature extraction techniques to represent items in a recommender system.	6	3	3																														
	(ii) Analyse how hybrid systems overcome the limitations of content-based filtering.	6	3	4																														

5(A)	(i)	Apply Non-negative Matrix Factorization (NMF) in a recommendation scenario.	6	4	3
	(ii)	Analyse how CNN improves recommendation performance.	6	4	4
OR					
5(B)		What is Singular Value Decomposition (SVD)? Explain how SVD is used for dimensionality reduction in recommender systems.	12	4	5
6(A)	(i)	Use fairness and bias detection techniques in recommender systems.	6	5	3
	(ii)	Analyse the outcomes of A/B testing in decision making.	6	5	4
OR					
6(B)		Apply precision, recall, and F1-score to evaluate a recommender system and analyse their effectiveness in measuring performance.	12	5	4

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Hall Ticket No:

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Question Paper Code: 23CAI403

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May – 2026**PREDICTIVE ANALYTICS**

(CSE - Artificial Intelligence)

Time: 3Hrs

Max Marks: 70

Attempt all the questions. All parts of the question must be answered in one place only.
All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S.No.	Question	Marks	CO	BL
1.	i) Why is Predictive Analytics considered important for business decision-making?	1M	1	1
	ii) How does supervised learning differ from unsupervised learning?	1M	1	1
	iii) Which technique is used to handle missing values in a dataset?	1M	2	1
	iv) State one difference between normalization and standardization.	1M	2	1
	v) State the difference between Linear Regression and Polynomial Regression.	1M	3	1
	vi) Which performs better for small datasets: k-NN or SVM?	1M	3	1
	vii) Define accuracy in classification.	1M	4	1
	viii) What does a high variance model indicate?	1M	4	1
	ix) What is Ensemble Learning?	1M	5	1
	x) Why is ethics important in predictive analytics?	1M	5	1
2(A)	Describe the types of predictive models. Explain Classification, Regression, and Time Series models with simple examples.	12M	1	2
OR				
2(B)	Describe the application of Predictive Analytics in Marketing, Finance & Healthcare.	12M	1	2
3(A)	Explain why data cleaning is importance in predictive analytics. Describe methods used to handle missing, noisy, and inconsistent data.	12M	2	2
OR				
3(B)	Describe how categorical variables are encoded for machine learning models. Explain different encoding techniques.	12M	2	2
4(A)	A company wants to predict whether a customer will purchase a product based on their income and age. You are given the following dataset:	12M	3	3

Customer	Age	Income (₹ in Lakhs)	Purchased (Yes=1, No=0)
1	25	3	0
2	35	6	1
3	45	8	1
4	20	2	0
5	30	4	0

- (i) Apply Logistic Regression to compute the probability of purchase for a new customer with Age = 40, Income = 7 (Assume $b_0 = -10$, $b_1 = 0.1$, $b_2 = 0.8$)
- (ii) Classify the result using a threshold of 0.5.
- (iii) Explain how this model differs from Linear Regression.

OR

- 4(B)** Using the k-Nearest Neighbors (k-NN) algorithm with $k = 3$, classify the new data point $P(4, 5)$ based on the following dataset: 12M 3 3

Point	X	Y	Class
A	2	3	Class 1
B	3	4	Class 1
C	5	6	Class 2
D	7	8	Class 2
E	3	5	Class 1

- 5(A)** Given dataset of 5 samples: 12M 4 3
- (i) Apply LOOCV
 - (ii) Show number of iterations
 - (iii) Explain advantages & disadvantages

OR

- 5(B)** Given parameter grid: 12M 4 3

C	Accuracy
0.1	80%
1	85%
10	83%

- (i) Select best parameter
- (ii) Explain grid search process
- (iii) Apply result

- 6(A)** Explain time series forecasting and describe the working of ARIMA model 12M 5 2

OR

- 6(B)** A retail company wants to predict future sales using past data. The dataset includes daily sales, customer behaviour, and seasonal trends. The company plans to use machine learning models and deploy the system for real-time predictions. 12M 5 2

Answer the following:

- (i) Which model would you choose (ARIMA, XGBoost, or LSTM) for this problem? Justify your choice.
- (ii) Explain how ensemble learning (Bagging/Boosting) can improve prediction accuracy.
- (iii) Describe the steps to build and deploy an end-to-end predictive system.
- (iv) Identify possible ethical and privacy issues and suggest solutions.

*****END*****

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May - 2026**BLOCKCHAIN FOR AI**

(CSE - Artificial Intelligence)

Time: 3Hrs

Max Marks: 70

Attempt all the questions. All parts of the question must be answered in one place only.

All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S.No.	Question	Marks	CO	BL
1.	i) Define Merkle Tree.	1	1	1
	ii) State the role of Nonce in blockchain.	1	1	1
	iii) List the features of Ethereum.	1	2	1
	iv) Differentiate PoW and PBFT.	1	2	1
	v) Name one application of AI in blockchain.	1	3	1
	vi) State the meaning of data integrity.	1	3	1
	vii) List one example of blockchain in IoT.	1	4	1
	viii) Give one example of NFT use in AI.	1	4	1
	ix) Define Sybil attack.	1	5	1
	x) Identify one scalability issue in blockchain.	1	5	1
2(A)	Explain Distributed Ledger Technology (DLT) in detail.	12	1	2
OR				
2(B)	Explain P2P network architecture used in blockchain.	12	1	2
3(A)	Analyze the use of Gas and Events in Ethereum with examples.	12	2	4
OR				
3(B)	Describe the purpose of transactions and events in Ethereum.	12	2	2
4(A)	Explain data integrity and provenance in AI systems using blockchain.	12	3	2
OR				
4(B)	Illustrate AI optimization in blockchain consensus mechanisms.	12	3	3
5(A)	Analyze the use case of Explainable AI in connection with blockchain.	12	4	4
OR				
5(B)	Evaluate the application of smart contracts in financial AI systems.	12	4	4
6(A)	Analyze ethical and legal concerns in AI with blockchain.	12	5	4
OR				
6(B)	Evaluate security challenges in integrating AI with blockchain.	12	5	4

END

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE
(UGC-AUTONOMOUS INSTITUTION)**B. Tech III Year II Semester (R23) Regular End Semester Examinations, May - 2026**
CYBERSECURITY AND AI-DRIVEN THREAT DETECTION
(CSE – Artificial Intelligence)

Time: 3Hrs

Max Marks: 70

Attempt all the questions. All parts of the question must be answered in one place only.
All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

S.No.	Question	Marks	CO	BL
1.	i) State the difference between symmetric and asymmetric encryption.	1	1	1
	ii) State the purpose of risk assessment in cybersecurity.	1	1	1
	iii) List two classification models commonly used for network intrusion detection.	1	2	1
	iv) List the evaluation metrics used to measure machine learning model performance.	1	2	1
	v) List the uses of RNNs in log analysis.	1	3	1
	vi) Show how deep learning is used in threat detection.	1	3	1
	vii) Write the full form of SIEM and state its purpose.	1	4	1
	viii) Name the three tools that form the ELK Stack.	1	4	1
	ix) State what ethical hacking is and identify two ways it differs from illegal hacking.	1	5	1
	x) What is federated threat detection?	1	5	1
2(A)	(i) Explain the process of risk assessment in cyber security and outline its key steps	6	1	2
	(ii) Describe the OWASP Top 10 security risks and how they impact web applications	6	1	2
OR				
2(B)	Explain the RSA algorithm in cryptography. Then, illustrate the process of encryption and decryption using RSA for the given values: $p=3$, $q=11$, $e=7$ and $m=5$.	12	1	2
3(A)	Identify the critical preprocessing steps required for security data before training machine learning models. a) Data cleaning b) Handling missing values c) Normalization d) Feature selection	12	2	3
OR				
3(B)	Apply evaluation metrics in ML-based threat detection systems and demonstrate the use of Accuracy, Precision, Recall, F1-Score, and ROC curve with suitable examples.	12	2	3
4(A)	Construct the architecture of autoencoders and apply them to detect anomalies in cybersecurity systems.	12	3	3
OR				
4(B)	Identify the architecture of deep neural networks (DNNs) and explain how to apply them for modern cybersecurity applications, including intrusion detection and threat intelligence.	12	3	3

5(A)	Describe Threat Intelligence Platforms (TIPs) and illustrate their integration with SIEM for improved security monitoring.	12	4	2
OR				
5(B)	Explain the structure of a SOC and how AI supports its operations.	12	4	2
6(A)	Demonstrate ethical hacking and write the five phases of penetration testing with AI tool support.	12	5	2
OR				
6(B)	Contrast GDPR, HIPAA, and Cyber Law in terms of their purpose and scope in data privacy protection.	12	5	2

*****END*****