

9

# JK Lakshmipat University Jaipur

## INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, May 2026  
B. Tech., Semester VI (Department Elective)

Roll No.....

CS1258: Cognitive Computing

Time: 2 hour 30 Minutes

Max. Marks: 30

### Instructions to students:

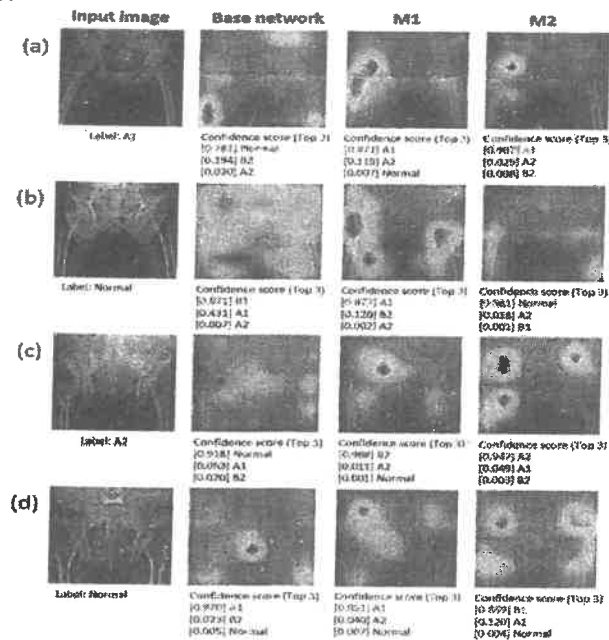
1. Assume suitable data wherever required and mention it clearly.
2. Write clear and concise answers with proper diagrams where required.
3. Use of a normal (non-programmable) calculator is permitted.

Q.1

A cognitive computing-based bone fracture detection system is developed using deep learning to analyze X-ray images from the MURA Dataset. The system uses a Convolutional Neural Network (CNN) to classify fractures and applies Grad-CAM++ to generate heatmaps highlighting critical regions in the X-ray.

2+2+2  
Marks  
CO4,  
CO2

The system mimics human thinking by identifying patterns such as bone discontinuity and provides predictions with visual explanations. It assists doctors by improving accuracy and reducing diagnosis time, especially for small fractures.



- **Analyze** how cognitive computing enhances medical image interpretation compared to manual diagnosis.
- **Evaluate** the importance of recall in this system where missing a fracture can be critical.

- **Examine** how explainable AI (heatmaps) builds trust in the model's decisions. Finally, **suggest** how this system can be improved for real-world healthcare deployment.

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| <b>Q.2</b> | <p>A smart water monitoring system is developed for the Bisalpur Dam using historical and forecast data. It uses a <b>LightGBM model</b> to generate probabilistic rainfall predictions (P10, P50, P90) and a <b>water balance model</b> to estimate storage. The operator must decide daily water release to manage flood and drought risks.</p> <p><b>Dataset</b></p> <ul style="list-style-type: none"> <li>• <b>Capacity:</b> 1095 MCM</li> <li>• <b>Current Storage:</b> 820 MCM</li> <li>• <b>Rainfall (7 days):</b> P10 = 20 mm, P50 = 40 mm, P90 = 85 mm</li> <li>• <b>Daily Inflow:</b> 69 MCM</li> <li>• <b>Losses + Demand:</b> 8 MCM/day</li> <li>• <b>Release Options:</b> <ul style="list-style-type: none"> <li>○ 5% = 54.75 MCM</li> <li>○ 10% = 109.5 MCM</li> </ul> </li> </ul> <ul style="list-style-type: none"> <li>• Explain how probabilistic rainfall improves decisions over single forecast.</li> <li>• Evaluate the role of the water balance equation in storage prediction.</li> <li>• Use <b>40 mm rainfall</b> to suggest a suitable release strategy.</li> <li>• Analyze how flood/drought risk scores affect decisions.</li> <li>• Compare impact of <b>5% vs 10% release</b>.</li> <li>• Justify using LightGBM over LSTM.</li> <li>• Suggest two improvements to the system.</li> </ul> | <p><b>06 Marks</b><br/>CO3,<br/>CO5</p> |
| <b>Q.3</b> | <p>An AI-based healthcare system predicts diseases like Diabetes, Heart Disease, and Pneumonia using clinical data and X-ray images. It generates a <b>risk score (0–100%)</b> and classifies patients into risk levels.</p> <p><b>Dataset</b></p> <ul style="list-style-type: none"> <li>• <b>Inputs:</b> Age, BP, Glucose, BMI, X-ray result</li> <li>• <b>Sample Output:</b> <ul style="list-style-type: none"> <li>○ Patient A → 65% (Moderate Risk)</li> <li>○ Patient B → 85% (High Risk)</li> <li>○ Patient C → 20% (Low Risk)</li> </ul> </li> <li>• <b>Risk Levels:</b> <ul style="list-style-type: none"> <li>○ 0–30 → Low</li> <li>○ 31–70 → Moderate</li> <li>○ 71–100 → High</li> </ul> </li> <li>• <b>Model Performance:</b> <ul style="list-style-type: none"> <li>○ Accuracy: 88%</li> <li>○ Precision: 85%</li> <li>○ Recall: 82%</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p><b>06 Marks</b><br/>CO3,<br/>CO5</p> |

Do the followings-

1. Analyze how cognitive computing techniques improve medical diagnosis.
2. Evaluate the use of structured and image-based data.
3. Interpret a patient with **65% risk**.
4. Examine the role of the AI assistant in healthcare.
5. Compare AI-based diagnosis with manual diagnosis.
6. Justify the importance of confusion matrix metrics.
7. Suggest two improvements for better system performance.

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| <p><b>Q.4</b></p> | <p>A cognitive computing-based system called TruthVision is designed to analyze and verify the authenticity of information using AI techniques. The system processes large volumes of data, identifies patterns, and detects misinformation through intelligent algorithms. It also uses natural language processing to understand and interpret textual content.</p> <ul style="list-style-type: none"> <li>• Explain how cognitive computing enables the system to differentiate between true and false information.</li> <li>• Discuss the role of pattern recognition and NLP in improving system accuracy.</li> <li>• Describe how such a system can be useful in real-world applications like media verification and decision-making.</li> </ul>                                                                                                                                                                                                                                                 | <p><b>2+2+2</b><br/><b>Marks</b><br/>CO4,<br/>CO6</p> |
| <p><b>Q.5</b></p> | <p>A cognitive computing-based cyber threat detection system is designed to identify malicious and benign content in emails using AI and Cyber Threat Intelligence. The system uses models like SecRoBERTa for threat classification, BERT-NER for entity extraction, and PhishFormer for phishing detection. It processes large volumes of email data, extracts key entities such as malware and threat actors, and provides explainable outputs using attention heatmaps.</p> <ul style="list-style-type: none"> <li>• Propose an improved model or system architecture to support real-time and multilingual cyber threat detection.</li> <li>• Discuss the role of NLP and transformer models in identifying phishing emails and extracting meaningful information.</li> <li>• Analyze the importance of explainable AI in building user trust in such systems. Also, describe the limitations of this system and suggest improvements for real-time and multilingual threat detection.</li> </ul> | <p><b>2+2+2</b><br/><b>Marks</b><br/>CO4,<br/>CO5</p> |

\*\*\*\*\***All The Best**\*\*\*\*\*

