

|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                   |                                                                   |                                                                             |                 |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------|
|  | <b>ARKA JAIN University</b><br>Jharkhand                                                                                                                                                                                                                                                                                                                                            |  | [01-05-2026]<br>END SEM EXAMINATION<br>School of Engineering & IT |                                                                             |                 |
| Program                                                                            | Bachelor of Computer Application                                                                                                                                                                                                                                                                                                                                                    |                                                                                   |                                                                   | Session                                                                     | Even, 2025-26   |
| Subject Name                                                                       | Software Engineering                                                                                                                                                                                                                                                                                                                                                                |                                                                                   |                                                                   | Year                                                                        | April, 2026*    |
| Semester                                                                           | VI                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                   |                                                                   | • Start writing from 2nd page onwards; don't Write on the 1st Page Backside |                 |
| Time: 3 Hour<br>Max. Marks : 70                                                    | • Answer all Questions of Section A (Compulsory)<br>• Answer Any Four out of Six of Section B<br>• Answer Any Three out of Five of Section C<br>• Possession of Mobile Phone or any kind of Written Material, Arguments with the Invigilator or Discussion with Co-Student will comes under <u>Unfair Means</u> and will <u>Result</u> in the <u>Cancellation of the Paper(s)</u> . |                                                                                   |                                                                   | K1 : Remembering                                                            | K5 : Evaluating |
| Knowledge Level (KL)                                                               | K1 : Remembering    K3 : Applying<br>K2 : Understanding    K4 : Analysing<br>K5 : Evaluating<br>K6 : Creating                                                                                                                                                                                                                                                                       |                                                                                   |                                                                   |                                                                             |                 |

**Section A (Each question Carry 02 Marks from Q1-i to x – 20 Marks)**

| Q.N  | QUESTIONS                                    | Marks | COs | KL   |
|------|----------------------------------------------|-------|-----|------|
| 1    |                                              |       |     |      |
| i    | List any two phases of SDLC.                 | 02    | CO1 | KL.1 |
| ii   | What is requirement analysis?                | 02    | CO1 | KL.1 |
| iii  | What are non-functional requirements?        | 02    | CO2 | KL.1 |
| iv   | Define Prototyping Model.                    | 02    | CO2 | KL.2 |
| v    | What is RAD (Rapid Application Development)? | 02    | CO1 | KL.1 |
| vi   | Define socio-technical systems.              | 02    | CO3 | KL.1 |
| vii  | What is software testing?                    | 02    | CO3 | KL.5 |
| viii | Define software maintenance.                 | 02    | CO2 | KL.4 |
| ix   | What is modular decomposition?               | 02    | CO4 | KL.3 |
| x    | What is UML?                                 | 02    | CO4 | KL.1 |



**Section B (Answer any FOUR out of SIX) – 20 Marks**  
(Each question Carry 05 Marks)

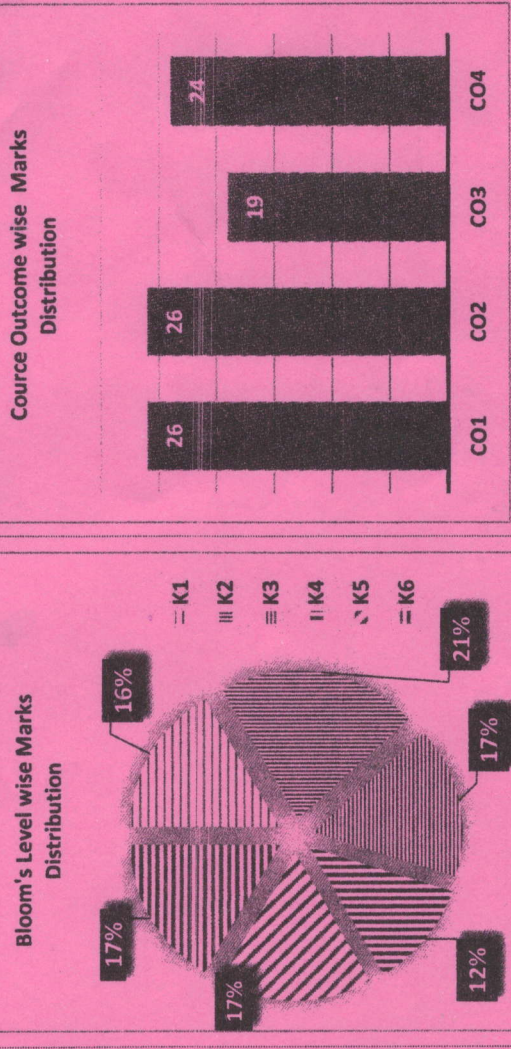
| Q. No. | QUESTIONS                                                          | Marks | COs | KL  |
|--------|--------------------------------------------------------------------|-------|-----|-----|
| 2      | Describe risk identification and risk mitigation techniques.       | 05    | CO1 | KL1 |
| 3      | Define verification and validation in software engineering.        | 05    | CO1 | KL2 |
| 4      | Explain the importance of process models in software engineering.  | 05    | CO4 | KL3 |
| 5      | Explain interface prototyping and interface evaluation techniques. | 05    | CO4 | KL5 |
| 6      | Define software architecture and explain its importance.           | 05    | CO3 | KL2 |
| 7      | Define critical systems and explain their types.                   | 05    | CO4 | KL6 |

**Section C (Answer any THREE out of FIVE) – 30 Marks**  
(Each question Carry 10 Marks)

| Q. No. | QUESTIONS                                                                                                                                                                                                                                      | Marks | COs | KL  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----|-----|
| 8      | Explain different components of systems such as organization, people, and computers.                                                                                                                                                           | 10    | CO4 | KL4 |
| 9      | Explain the 4 models of Software Development Life Cycle (SDLC) with neat diagram.                                                                                                                                                              | 10    | CO2 | KL2 |
| 10     | Define Software Project Management and explain its objectives. Describe major software management activities.                                                                                                                                  | 10    | CO1 | KL3 |
| 11     | Discuss software cost estimation techniques and factors affecting project duration and staffing.                                                                                                                                               | 10    | CO2 | KL6 |
| 12     | A software project of size 50 KLOC is developed under Semi-Detached mode with an Effort Adjustment Factor (EAF) of 1.2. Using the Intermediate COCOMO model, determine:<br>(a) Adjusted Effort<br>(b) Development Time<br>(c) Average Staffing | 10    | CO3 | KL5 |

| Course Outcomes                                                                 | CO1 | CO2 | CO3 | CO4 |
|---------------------------------------------------------------------------------|-----|-----|-----|-----|
| Understand the importance of the stages in the software development life cycle. |     |     |     |     |
| Understand the various process model.                                           |     |     |     |     |
| Understand the UML notation.                                                    |     |     |     |     |
| Be able to design software by applying the software engineering principles.     |     |     |     |     |

**GRAPHICAL REPRESENTATION**





|                                                                                                                                                                                                                                     |                           |                                                                                   |                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------|
|  <b>ARKA JAIN University</b><br>Jharkhand                                                                                                         |                           |  | [05-05-2026]<br><b>END SEM EXAMINATION</b><br>School of Engineering & IT |
| <b>Program</b> Bachelor of Computer Application                                                                                                                                                                                     |                           |                                                                                   |                                                                          |
| <b>Subject Name</b> Big data Analytics                                                                                                                                                                                              |                           | <b>Session</b> Even, 2025-26                                                      |                                                                          |
| <b>Semester</b> VI                                                                                                                                                                                                                  |                           | <b>Year</b> April, 2026                                                           |                                                                          |
| • Start writing from 2nd page onwards; <b>don't</b> Write on the 1st Page Backside                                                                                                                                                  |                           |                                                                                   |                                                                          |
| • Answer all Questions of Section A (Compulsory)                                                                                                                                                                                    |                           |                                                                                   |                                                                          |
| • Answer Any Four out of Six of Section B                                                                                                                                                                                           |                           |                                                                                   |                                                                          |
| • Answer Any Three out of Five of Section C                                                                                                                                                                                         |                           |                                                                                   |                                                                          |
| • Possession of Mobile Phone or any kind of Written Material, Arguments with the Invigilator or Discussion with Co-Student will comes under <u>Unfair Means</u> and will <u>Result</u> in the <u>Cancellation of the Paper(s)</u> . |                           |                                                                                   |                                                                          |
| Time: 3 Hour<br>Max. Marks : 70                                                                                                                                                                                                     |                           |                                                                                   |                                                                          |
| <b>Knowledge Level (KL)</b>                                                                                                                                                                                                         | <b>K1 : Remembering</b>   | <b>K3 : Applying</b>                                                              | <b>K5 : Evaluating</b>                                                   |
|                                                                                                                                                                                                                                     | <b>K2 : Understanding</b> | <b>K4 : Analysing</b>                                                             | <b>K6 : Creating</b>                                                     |

| Section A (Each question Carry 02 Marks from Q1-i to x – 20 Marks) |                                      |       |     |    |
|--------------------------------------------------------------------|--------------------------------------|-------|-----|----|
| Q. N                                                               | QUESTIONS                            | Marks | COs | KL |
| 1                                                                  |                                      |       |     |    |
| i                                                                  | What is meant by data explosion?     | 02    | CO1 | K1 |
| ii                                                                 | Define unstructured data.            | 02    | CO3 | K1 |
| iii                                                                | Name any two Hadoop core components. | 02    | CO3 | K3 |
| iv                                                                 | Define NameNode in Hadoop.           | 02    | CO4 | K2 |
| v                                                                  | What is fault tolerance in Hadoop?   | 02    | CO4 | K4 |
| vi                                                                 | Name any two Big Data tools.         | 02    | CO1 | K5 |
| vii                                                                | What is a Combiner in MapReduce?     | 02    | CO1 | K5 |
| viii                                                               | What is shuffling in MapReduce?      | 02    | CO4 | K6 |
| ix                                                                 | What is real-time data processing?   | 02    | CO4 | K2 |



| x                                                                                            | Mention any two Big Data use cases.                                                 | 02    | CO4 | K1 |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------|-----|----|
| <b>Section B (Answer any FOUR out of SIX) – 20 Marks</b><br>(Each question Carry 05 Marks)   |                                                                                     |       |     |    |
| Q. No.                                                                                       | QUESTIONS                                                                           | Marks | COs | KL |
| 2                                                                                            | Explain the difference between traditional IT systems and Big Data technologies.    | 05    | CO4 | K3 |
| 3                                                                                            | Explain the Lifecycle Phases of Big data Analytics.                                 | 05    | CO2 | K2 |
| 4                                                                                            | Explain HDFS architecture with diagram in detail.                                   | 05    | CO1 | K4 |
| 5                                                                                            | What is Data pre-processing? Explain the steps involved in it.                      | 05    | CO4 | K5 |
| 6                                                                                            | What are different types of Analytics in Big Data?                                  | 05    | CO3 | K1 |
| 7                                                                                            | Write short notes on tools used in Big Data streaming.                              | 05    | CO4 | K3 |
| <b>Section C (Answer any THREE out of FIVE) – 30 Marks</b><br>(Each question Carry 10 Marks) |                                                                                     |       |     |    |
| Q. No.                                                                                       | QUESTIONS                                                                           | Marks | COs | KL |
| 8                                                                                            | Explain MapReduce process (Mapping, Sorting, Shuffling, and Reducing) with example. | 10    | CO4 | K2 |
| 9                                                                                            | Explain the five V's of Big data in details.                                        | 10    | CO3 | K4 |
| 10                                                                                           | Explain YARN architecture and its components.                                       | 10    | CO4 | K5 |
| 11                                                                                           | Describe Big Data use cases in industries (healthcare, banking, and e-commerce).    | 10    | CO2 | K1 |
| 12                                                                                           | Discuss the capabilities and limitations of Big Data.                               | 10    | CO1 | K3 |

CO- Course Outcomes, KL- Knowledge Level, PO – Program Outcome

| Course Outcomes                                                                                                                   | CO1 | CO2                                          | CO3 | CO4 |
|-----------------------------------------------------------------------------------------------------------------------------------|-----|----------------------------------------------|-----|-----|
| Understand the concept & characteristics of big data.                                                                             |     |                                              |     |     |
| Explore Hadoop framework and its components. Use HDFS and Map Reduce to analyze various industry use cases of big data analytics. |     |                                              |     |     |
| Understand the YARN Infrastructure.                                                                                               |     |                                              |     |     |
| Learning different Sorting, Shuffling algorithm of mapreduce & understand the concept of big data streaming.                      |     |                                              |     |     |
| <b>GRAPHICAL REPRESENTATION</b>                                                                                                   |     |                                              |     |     |
| <b>Bloom's Level wise Marks Distribution</b>                                                                                      |     | <b>Course Outcomewise Marks Distribution</b> |     |     |
|                                                                                                                                   |     |                                              |     |     |





**ARKA JAIN**  
**University**  
Jharkhand



[05-05-2026]

**END SEM EXAMINATION**  
**School of Engineering & IT**

| Program                         | Bachelor of Computer Application                                                                                                                                                                                                                                                                                                                                            |                |                 |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------|
| Subject Name                    | Artificial Neural Networks                                                                                                                                                                                                                                                                                                                                                  | Session        | Even, 2025-26   |
| Semester                        | VI                                                                                                                                                                                                                                                                                                                                                                          | Year           | April, 2026     |
| Time: 3 Hour<br>Max. Marks : 70 | • Start writing from 2nd page onwards; <u>don't Write on the 1st Page Backside</u>                                                                                                                                                                                                                                                                                          |                |                 |
|                                 | • Answer all Questions of Section A (Compulsory)<br>• Answer Any Four out of Six of Section B<br>• Answer Any Three out of Five of Section C<br>• Possession of Mobile Phone or any kind of Written Material, Arguments with the Invigilator or Discussion with Co-Student will comes under <u>Unfair Means</u> and will <u>Result in the Cancellation of the Paper(s).</u> |                |                 |
| Knowledge Level (KL)            | K1 : Remembering                                                                                                                                                                                                                                                                                                                                                            | K3 : Applying  | K5 : Evaluating |
|                                 | K2 : Understanding                                                                                                                                                                                                                                                                                                                                                          | K4 : Analysing | K6 : Creating   |

**Section A (Each question Carry 02 Marks from Q1-i to x – 20 Marks)**

| Q. N | QUESTIONS                                         | Marks | COs | KL |
|------|---------------------------------------------------|-------|-----|----|
| 1    |                                                   |       |     |    |
| i    | Define a Neural Network.                          | 02    | CO1 | K1 |
| ii   | What is Universal Function Approximation?         | 02    | CO1 | K2 |
| iii  | What activation function is commonly used in MLP? | 02    | CO2 | K2 |
| iv   | What is a Self-Organizing Map (SOM)?              | 02    | CO3 | K2 |
| v    | What is the biological neuron?                    | 02    | CO1 | K1 |
| vi   | What is lateral inhibition?                       | 02    | CO3 | K2 |
| vii  | What is a learning mechanism?                     | 02    | CO1 | K1 |
| viii | Define Principal Component Analysis (PCA).        | 02    | CO1 | K2 |
| ix   | What is a Radial Basis Function (RBF) Network?    | 02    | CO1 | K2 |
| x    | What is a perceptron?                             | 02    | CO1 | K2 |



# Section B (Answer any FOUR out of SIX) – 20 Marks

(Each question Carry 05 Marks)

| Q. No. | QUESTIONS                                                | Marks | COs | KL |
|--------|----------------------------------------------------------|-------|-----|----|
| 2      | What is associative memory?                              | 05    | CO1 | K2 |
| 3      | Explain applications of RBF networks.                    | 05    | CO2 | K3 |
| 4      | Explain the architecture of a Self-Organizing Map.       | 05    | CO3 | K3 |
| 5      | Compare Classical AI and Neural Networks.                | 05    | CO1 | K4 |
| 6      | Draw and explain the structure of a biological neuron.   | 05    | CO1 | K2 |
| 7      | Explain the artificial neuron model with a neat diagram. | 05    | CO1 | K2 |

# Section C (Answer any THREE out of FIVE) – 30 Marks

(Each question Carry 10 Marks)

| Q. No. | QUESTIONS                                                                                                | Marks | COs | KL |
|--------|----------------------------------------------------------------------------------------------------------|-------|-----|----|
| 8      | Briefly explain the basic building blocks of artificial Neural Networks.                                 | 10    | CO1 | K2 |
| 9      | Describe the structure and functioning of a biological neuron and its analogy with an artificial neuron. | 10    | CO1 | K4 |
| 10     | Discuss local minima and global minima issues in learning mechanisms.                                    | 10    | CO4 | K4 |
| 11     | Explain the structure and representation of a perceptron in detail.                                      | 10    | CO1 | K4 |
| 12     | Discuss the importance of nonlinear activation functions in universal approximation.                     | 10    | CO1 | K3 |

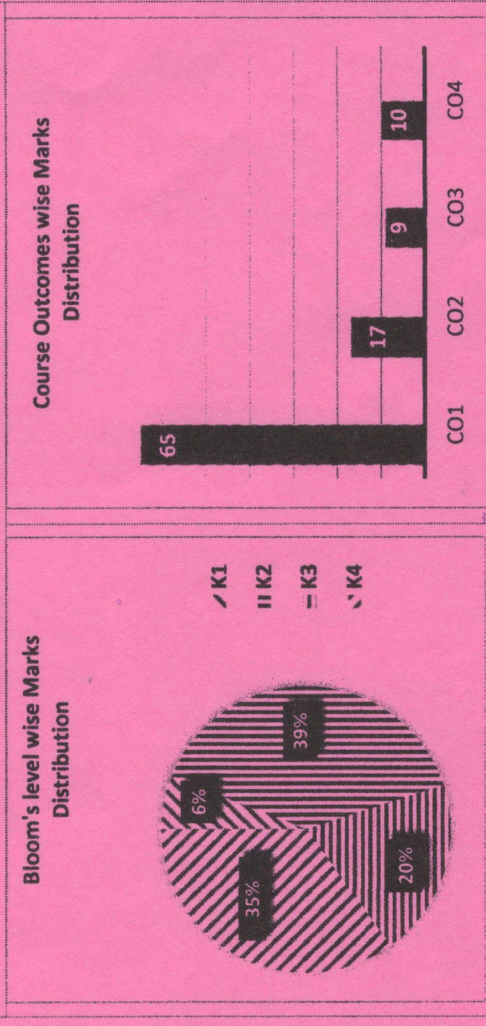
CO- Course Outcomes,

KL- Knowledge Level,

PO – Program Outcome

|     |                                                                                         |
|-----|-----------------------------------------------------------------------------------------|
| CO1 | Understand basic concepts of neural networks.                                           |
| CO2 | Use neural networks to perform classification for single class and multiclass problems. |
| CO3 | Learn and apply the concept of self-organizing maps.                                    |
| CO4 | To be able to formalize the problem, to solve it by using a neural network              |

## GRAPHICAL REPRESENTATION





|                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                              |                                                                          |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|--------------------------------------------------------------------------|
| <b>JGI</b>                      | <b>ARKA JAIN University</b><br>Jharkhand                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>NAAC GRADE A</b><br>ACCREDITED UNIVERSITY | [07-05-2026]<br><b>END SEM EXAMINATION</b><br>School of Engineering & IT |
| Program                         | Bachelor of Computer Application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                              |                                                                          |
| Subject Name *                  | Natural Language Processing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Session                                      | Even, 2025-26                                                            |
| Semester                        | VI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Year                                         | April, 2026                                                              |
| Time: 3 Hour<br>Max. Marks : 70 | <ul style="list-style-type: none"> <li>Start writing from 2nd page onwards; don't Write on the 1st Page *</li> <li>Backside</li> <li>Answer all Questions of Section A (Compulsory)</li> <li>Answer Any Four out of Six of Section B</li> <li>Answer Any Three out of Five of Section C</li> <li>Possession of <u>Mobile Phone</u> or any kind of <u>Written Material, Arguments with the Invigilator or Discussion with Co-Student</u> will comes under <u>Unfair Means</u> and will <u>Result in the Cancellation of the Paper(s).</u></li> </ul> |                                              |                                                                          |
| Knowledge Level (KL)            | K1 : Remembering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | K3 : Applying                                | K5 : Evaluating                                                          |
|                                 | K2 : Understanding                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | K4 : Analysing                               | K6 : Creating                                                            |

| Section A (Each question Carry 02 Marks from Q1-i to x - 20 Marks) |                                                                         |       |     |    |
|--------------------------------------------------------------------|-------------------------------------------------------------------------|-------|-----|----|
| Q.N                                                                | QUESTIONS                                                               | Marks | COs | KL |
| i                                                                  | List any two levels of linguistic analysis used in NLP.                 | 02    | CO1 | K2 |
| ii                                                                 | What are the main phases in Natural Language Understanding (NLU)?       | 02    | CO2 | K1 |
| iii                                                                | What is a Finite-State Automaton (FSA)?                                 | 02    | CO2 | K2 |
| iv                                                                 | What is the difference between deterministic and non-deterministic FSA? | 02    | CO2 | K2 |
| v                                                                  | What are the components of a CFG?                                       | 02    | CO2 | K1 |
| vi                                                                 | Define Top-Down Parsing                                                 | 02    | CO2 | K1 |
| vii                                                                | What is statistical modelling in NLP                                    | 02    | CO1 | K1 |
| viii                                                               | Name any two mathematical methods used in NLP.                          | 02    | CO1 | K1 |
| ix                                                                 | What is a transition function in FSA?                                   | 02    | CO2 | K2 |
| x                                                                  | What are human Factor in system design                                  | 02    | CO3 | K2 |



**Section B (Answer any FOUR out of SIX) – 20 Marks**  
(Each question Carry 05 Marks)

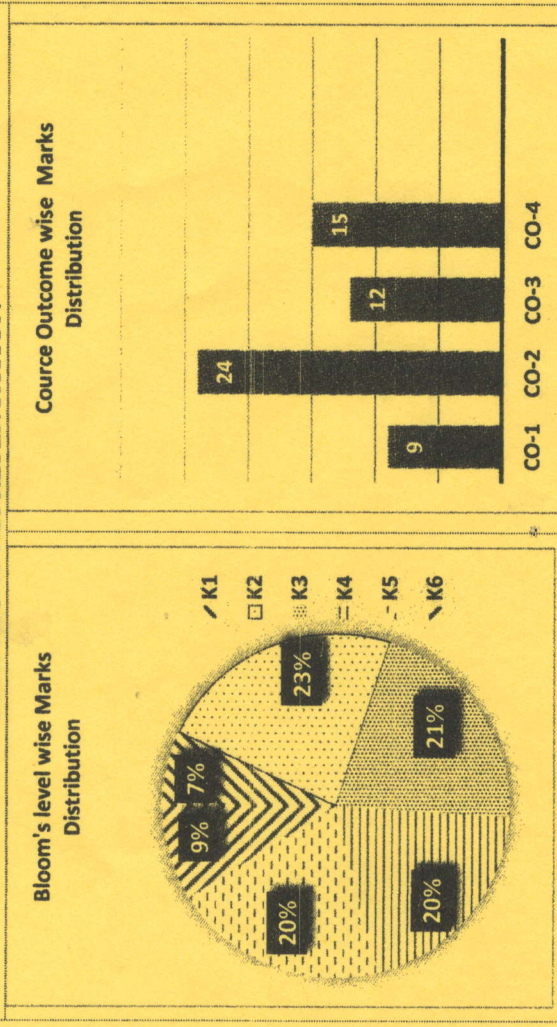
| Q. No. | QUESTIONS                                                                | Marks | COs | KL |
|--------|--------------------------------------------------------------------------|-------|-----|----|
| 2      | Explain the Concept of machine translation and its significance          | 05    | CO1 | K2 |
| 3      | Describe text Summarization and its types                                | 05    | CO1 | K2 |
| 4      | Explain how sentiment analysis works with simple example                 | 05    | CO3 | K3 |
| 5      | Describe the role of NLP in information retrieval and text search system | 05    | CO3 | K2 |
| 6      | Explain the concept of future engineering in NLP with example            | 05    | CO4 | K3 |
| 7      | Describe the working of Naïve bayes classifier for text classification   | 05    | CO4 | K4 |

**Section C (Answer any THREE out of FIVE) – 30 Marks**  
(Each question Carry 10 Marks)

| Q. No. | QUESTIONS                                                                                                                    | Marks | COs | KL |
|--------|------------------------------------------------------------------------------------------------------------------------------|-------|-----|----|
| 8      | Explain the Architecture And Functioning of chatbot and virtual assistant with suitable example                              | 10    | CO4 | K2 |
| 9      | Evaluate the impact of NLP application such as Dialogue System and information retrieval as modern digital platform          | 10    | CO3 | K5 |
| 10     | Analyze the working of text classification system with Reference to spam filtering and topic modelling                       | 10    | CO4 | K4 |
| 11     | Explain the complete pipeline of natural language generation system with suitable example                                    | 10    | CO4 | K3 |
| 12     | Describe how NLP techniques are applied to social media analysis for opinion mining, trend detection and fake news detection | 10    | CO3 | K4 |

|     |                                                                           |
|-----|---------------------------------------------------------------------------|
| CO1 | How key concepts from NLP are used to describe and analyze language       |
| CO2 | POS tagging and context free grammar for English language                 |
| CO3 | Understanding semantics and pragmatics of English language for processing |
| CO4 | Writing programs to carry out natural language processing                 |

**GRAPHICAL REPRESENTATION**





|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                                                                                                                                |                                  |                                                                          |               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------|--------------------------------------------------------------------------|---------------|
|  <b>ARKA JAIN University</b><br>Jharkhand                                                                                                                                                                                                                                                                                                                                                                     |  |  <b>NAAC GRADE A</b><br>ACCREDITED UNIVERSITY |                                  | [07-05-2026]<br><b>END SEM EXAMINATION</b><br>School of Engineering & IT |               |
| Program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                                                                                                | Bachelor of Computer Application |                                                                          |               |
| Subject Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  | Time Series Analysis                                                                                                           |                                  | Session                                                                  | Even, 2025-26 |
| Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  | VI                                                                                                                             |                                  | Year                                                                     | April, 2026*  |
| • Start writing from 2nd page onwards; <u>don't Write on the 1st Page Backside</u><br>• Answer all Questions of Section A (Compulsory)<br>• Answer Any <u>Four</u> out of Six of Section B<br>• Answer Any <u>Three</u> out of Five of Section C<br>• Possession of <u>Mobile Phone</u> or any kind of <u>Written Material, Arguments with the Invigilator or Discussion with Co-Student</u> will comes under <u>Unfair Means</u> and will <u>Result in the Cancellation of the Paper(s)</u> . |  |                                                                                                                                |                                  |                                                                          |               |
| Time: 3 Hour                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                                                                                                                                |                                  |                                                                          |               |
| Max. Marks : 70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                                                                                                                                |                                  |                                                                          |               |
| Knowledge Level (KL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  | K1 : Remembering                                                                                                               | K3 : Applying                    | K5 : Evaluating                                                          |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  | K2 : Understanding                                                                                                             | K4 : Analysing                   | K6 : Creating                                                            |               |

| Section A (Each question Carry 02 Marks from Q1-i to x - 20 Marks) |   |                                                                                      |  |       |     |
|--------------------------------------------------------------------|---|--------------------------------------------------------------------------------------|--|-------|-----|
| Q. N                                                               | 1 | QUESTIONS                                                                            |  | Marks | COs |
| i                                                                  |   | Which component of a time series represents long-term movement?                      |  | 02    | CO1 |
| ii                                                                 |   | For what purpose is the method of least squares mainly used in time series analysis? |  | 02    | CO1 |
| iii                                                                |   | In an Autoregressive (AR) model, the current value of a time series depends on what? |  | 02    | CO1 |
| iv                                                                 |   | On what is a Moving Average (MA) model based?                                        |  | 02    | CO1 |
| v                                                                  |   | For what purpose is the Box-Jenkins methodology mainly used?                         |  | 02    | CO1 |
| vi                                                                 |   | What are ACF and PACF primarily used for in time series analysis?                    |  | 02    | CO1 |
| vii                                                                |   | What does a multivariate time series consist of?                                     |  | 02    | CO1 |
| viii                                                               |   | Vector ARMA models are an extension of which type of models?                         |  | 02    | CO1 |
| ix                                                                 |   | What does cointegration indicate in multivariate time series analysis?               |  | 02    | CO4 |
| x                                                                  |   | In VAR models, each variable is explained as a function of what?                     |  | 02    | CO5 |



| Section B (Answer any FOUR out of SIX) – 20 Marks   |                                                                                                                                       |       |          |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-------|----------|
| (Each question Carry 05 Marks)                      |                                                                                                                                       |       |          |
| Q. No.                                              | QUESTIONS                                                                                                                             | Marks | COs - KL |
| 2                                                   | Define multivariate time series and explain its importance.                                                                           | 05    | CO1 K2   |
| 3                                                   | Explain the concept of stationarity in multivariate time series.                                                                      | 05    | CO3 K2   |
| 4                                                   | Describe the structure of a Vector Autoregressive (VAR) model.                                                                        | 05    | CO5 K2   |
| 5                                                   | Differentiate between univariate ARMA and vector ARMA models.                                                                         | 05    | CO1 K2   |
| 6                                                   | Explain the concept of cointegration with a simple example.                                                                           | 05    | CO1 K2   |
| 7                                                   | Explain the concept of autocorrelation and partial autocorrelation.                                                                   | 05    | CO3 K2   |
| Section C (Answer any THREE out of FIVE) – 30 Marks |                                                                                                                                       |       |          |
| (Each question Carry 10 Marks)                      |                                                                                                                                       |       |          |
| Q. No.                                              | QUESTIONS                                                                                                                             | Marks | COs - KL |
| 8                                                   | Describe the methods of trend determination using (a) Moving Averages and (b) Least Squares. Compare their advantages and limitations | 10    | CO1 K4   |
| 9                                                   | Explain the methods for determining seasonality: (a) Ratio to Trend Method and (b) Ratio to Moving Average Method.                    | 10    | CO1 K3   |
| 10                                                  | Analyze the role of ACF and PACF in identifying appropriate AR and MA models.                                                         | 10    | CO2 K4   |
| 11                                                  | Describe the ARCH model with its assumptions, properties, and applications in financial time series.                                  | 10    | CO1 K2   |
| 12                                                  | Discuss Vector ARMA models. Compare them with VAR models in terms of complexity and forecasting ability.                              | 10    | CO1 K4   |

| Course Outcomes                                                                  | CO1 | CO2 | CO3                                    | CO4 | CO5 |
|----------------------------------------------------------------------------------|-----|-----|----------------------------------------|-----|-----|
| Understand the different elementary models related to time series analysis.      |     |     |                                        |     |     |
| Apply different model evaluation technique to identify better model to forecast. |     |     |                                        |     |     |
| Understand the importance of stationarity in building time series models.        |     |     |                                        |     |     |
| Understand the use of Granger Causality and Johansen Cointegration method.       |     |     |                                        |     |     |
| Apply VAR model to the dynamic behaviour of financial time series conditions     |     |     |                                        |     |     |
| GRAPHICAL REPRESENTATION                                                         |     |     |                                        |     |     |
| Blooms Level Wise Marks Distribution                                             |     |     | Course Outcome Wise Marks Distribution |     |     |
|                                                                                  |     |     |                                        |     |     |