MASTER OF COMPUTER APPLICATIONS (MCA_NEW)

MCA_NEW 3rd Semester Assignments

(January,2026 & July,2026 sessions)

MCS-224, MCS-225, MCS-226, MCS-227

MCSL-228, MCSL-229

SCHOOL OF COMPUTER AND INFORMATION SCIENCES
INDIRA GANDHI NATIONAL OPEN UNIVERSITY
MAIDAN GARHI, NEW DELHI – 110 068

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Course Code	**:**	**MCS-224**
Course Title	**:**	**Artificial Intelligence and Machine Learning**
Assignment Number	**:**	**MCA_NEW(III)/224/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last date of Submission	**:**	**30th April, 2026 (for January session)** **31st October, 2026 (for July session)**

This assignment has sixteen questions with a total marks 80, answer all questions. The remaining 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1: What is learning? Define the following ways of learning: **(5 Marks)**
(i) Rote Learning (ii) Learning by Instruction (iii) Learning by analogy (iv) Learning by Induction
(v) Learning by deduction

Q2: Define is Artificial Intelligence? What are the applications of AI in the healthcare and agricultural domains? **(4 Marks)**

Q3: Find the minimum cost path for the 8-puzzle problem, where the start and goal state are given as follows: **(4 Marks)**

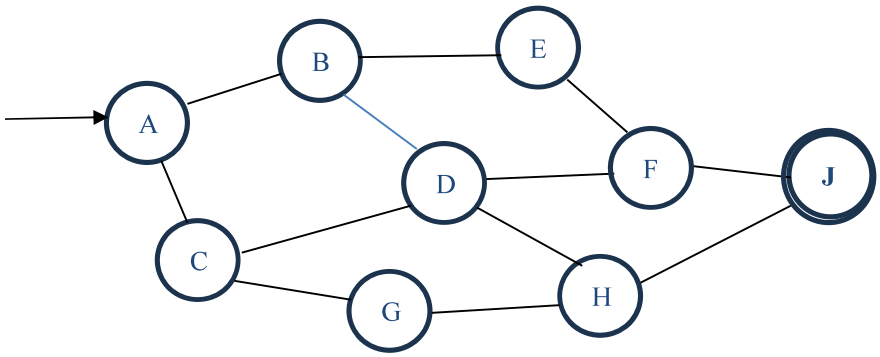
1	2	3
4	8	-
7	6	5

Start State

1	2	3
4	5	6
-	7	8

Goal State

Q4: Apply BFS algorithm on the following graph. **(5 Marks)**



Q5: Draw a semantic network for the following English statement: **(4 Marks)**
"Shyam owns a dog named Sheru, and Sheru likes to chase cats".

Q6: In a class, three students tossed one coin (one each) 3 times. Answer the following: **(4 Marks)**
(a) Write down all the possible outcomes which can be obtained in this experiment.
(b) What is the probability of getting 2 or more than 2 heads at a time? Also, write the probability of getting three tails at a time.
(c) Calculate the Relative frequency of tail $r_n(T)$.

Q7: Explain Dempster-Shafer theory with a suitable example. **(4 Marks)**

Q8: For the following fuzzy sets: **(5 Marks)**

A = { a/0.6, b/0.4, c/0.5, d/0.0, e/0.8}; B = {a/0.2, b/0.8, c/0.7, d/0.3, e/0.5}
C = {a/0.1, b/0.2, c/0.8, d/0.6, e/0.2}

Find the fuzzy sets:(i) A∪B∪C (ii) A∩B∩C (iii) A'∪B'∪C' (iv) A'∩B'∩C' (v) (A∩B∪C)'

Q9: What is ensemble learning? Explain three primary classes of ensemble learning methods. **(4 Marks)**

Q10: Use Naive Bayes classification method for the following dataset and classify the class (Species) of X={Color=Green, Legs=2, Height=Tall, Smelly=No} **(7 Marks)**

Sl. No.	Color	Legs	Height	Smelly	Species
1	White	3	Short	Yes	M
2	Green	2	Tall	No	M
3	Green	3	Short	Yes	M
4	White	3	Short	Yes	M
5	Green	2	Short	No	H
6	White	2	Tall	No	H
7	White	2	Tall	No	H
8	White	2	Short	Yes	H

Q11: What is a Decision Tree? Use ID3 algorithm to create the decision tree for the following dataset and use it to find the class of unknown sample X = {Peter, red, short, average} **(7 Marks)**

Independent Attributes / Condition Attributes					Dependent Attributes / Decision Attributes
Name	***Hair***	***Height***	***Weight***	***Lotion***	***Result***
Sarah	blonde	average	light	no	sunburned (positive)
Dana	blonde	tall	average	yes	none (negative)
Alex	brown	short	average	yes	none
Annie	blonde	short	average	no	sunburned
Emily	red	average	heavy	no	sunburned
Pete	brown	tall	heavy	no	none
John	brown	average	heavy	no	none
Katie	blonde	short	light	yes	none

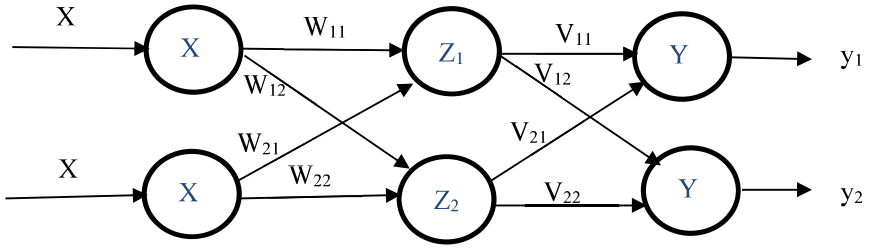
Q12: Find a quadratic regression model for the following data. Use the regression model and calculate the value of Y at X = 9. **(5 Marks)**

X	3	4	5	6	7
Y	2.5	3.2	3.8	6.5	11.5

Q13: For the given points of two classes Blue and Yellow: **(6 Marks)**
Blue: { (1,2), (2,3), (-1,2), (-1,4), (-1,-1)}
Yello: { (4,2), (5,-1), (5,1), (6,1), (5,3)}

Plot a graph for the Blue and Yello categories. Find the support vectors and optimal separatingline.

Q14: The following diagram represents a feed-forward neural network with one hidden layer: **(6 Marks)**



For the following input patterns, calculate the output of the network (y1 and y2) if weights are initialized as: $W_{11} = -1$, $W_{12} = 2$, $W_{21} = 1$, $W_{22} = -2$, $V_{11} = 2$, $V_{12} = -1$, $V_{21} = -2$, $V_{22} = 2$. Use activation function F(Y) =1 for Y>=0 and F(Y) = 0 otherwise.

Pattern	P_1	P_2	P_3	P_4
X_1	0	1	0	1
X_2	0	0	1	1

Q15: Consider the following two-dimensional pattern. Using PCA algorithm, calculate the principal component. **(5 Marks)**

X_i	2	4	5	6	6	7	9	8
Y_i	1	6	4	5	7	7	10	9

Q16: Explain Apriori algorithm with the help of a suitable example. **(5 Marks)**

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Course Code	**:**	**MCS-225**
Course Title	**:**	**Accountancy and Financial Management**
Assignment Number	**:**	**MCA_NEW(III)/225/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last date of Submission	**:**	**30th April, 2026 (for January session)** **31st October, 2026 (for July session)**

Note: This assignment has five questions, each of 16 marks. Answer all the questions. 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1: What is a balance sheet? Classify different balance sheet items and give examples. **(16 Marks)**

Q2: What is the utility of ratio analysis? Explain different ratios with examples. **(16 Marks)**

Q3: With the help of an example, explain how to prepare a funds flow statement and statement of changes in working capital. **(16 Marks)**

Q4: Explain the techniques of financial statements analysis. **(16 Marks)**

Q5: a) What is the cost of Capital? Explain its significance. **(8 Marks)**

Q5: b) What are Non-Performing Assets? Explain. **(8 Marks)**

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Course Code	**:**	**MCS-226**
Course Title	**:**	**Data Science and Big Data**
Assignment Number	**:**	**MCA_NEW(III)/226/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**30th April, 2026 (for January session)** **31st October, 2026 (for July session)**

This assignment has ten questions of 8 Marks each, answer all questions. Rest 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1: Explain the scope and objectives of **Data Science**. Discuss the importance of **data collection and sampling techniques** in data-driven decision making. Illustrate your answer with suitable examples.

Q2: Define **measures of central tendency and dispersion**. Explain how **variance and standard deviation** help in understanding data distribution. Discuss the relevance of these measures in Data Science applications.

Q3: What is **data preprocessing**? Explain the major steps involved in preprocessing large datasets. Discuss methods used for **noise removal, normalization, and data transformation**.

Q4: Explain the concept of **data visualization**. Discuss any four commonly used charts and justify their use for analyzing different types of datasets.

Q5: Discuss the need for **Big Data technologies**. Explain the **characteristics of Big Data** and describe how Big Data processing differs from traditional data processing systems.

Q6: Describe the architecture of the **Hadoop ecosystem**. Explain the role of **HDFS, YARN, and MapReduce** in handling large-scale data processing.

Q7: What is **Apache Spark**? Explain its core components and advantages over traditional Hadoop MapReduce. Discuss one practical application where Spark is effectively used.

Q8: Explain the concept of **NoSQL databases**. Compare **key-value stores**, **column-family databases**, and **document databases** with suitable examples and use cases.

Q9: Explain the techniques used for **similarity measurement** in Big Data analytics. Discuss **Jaccard similarity**, **cosine similarity**, and their role in recommendation systems.

Q10: Write R programs for the following tasks:
(a) Perform **simple linear regression** on a sample dataset and interpret the output.
(b) Apply a **classification technique** of your choice on a dataset and explain the results obtained.

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Course Code	**:**	**MCS-227**
Course Title	**:**	**Cloud Computing and IoT**
Assignment Number	**:**	**MCA_NEW(III)/227/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**30th April, 2026 (for January session)** **31st October, 2026 (for July session)**

This assignment has twenty questions of 80 Marks. Answer all questions. Rest 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1: Define Cloud Computing. List and explain the four categories of cloud deployment models. Differentiate between cluster, grid and cloud computing with respect to its characteristics, physical structure, hardware, resources, applications, networking and scalability features.

Q2: Define resource sharing in cloud computing. What is Tenancy in context of cloud computing? Explain the implementation of single tenancy and multi-tenancy types of resource sharing in cloud computing.

Q3: Define resource pooling in cloud environment. In this context, explain the following:

a. Server Pools
b. Storage Pools
c. Network Pools

Q4: Explain the differences between cloud computing, Fog computing and Edge computing. Draw a block diagram of Cloud-Fog-Edge collaboration and explain all itslayers.

Q5: Draw the block diagram of 3-layer architecture of fog computing and explain all its layers. Also, with the help of a block diagram, explain the 4-levels in Cloud architecture.

Q6: What is an Hypervisor? Compare the functionality of Type-1 and Type-2 Hypervisor with the help of suitable block diagram for each, also give advantages and disadvantages of each.

Q7: Define virtualization. Explain its underlying abstraction. Also mention the features provided by virtualization environment. Also, describe various Hypervisor based virtualization approaches like full virtualization, para virtualization and hardware assisted virtualization.

Q8: What is Internet of Things (IoT)? What are the characteristics of IoT? List and explain the various components used to implement IoT. Also explain industrial IoT, infrastructure IoT and internet of military things (IoMT) categories of IoT.

Q9: What is scalability in Cloud Computing? Explain the Proactive Scaling and Reactive Scaling strategies. Also, describe Auto scaling in cloud? Write and explain fixed amount auto scaling algorithm, with the help of a suitable example.

Q10: Explain the following communication protocols with reference to the IoT devices :

i. IPv6
ii. MQTT
iii. CoAP
iv. XMPP

Q11: Define Load Balancing. Explain the following algorithms with reference to load balancing :

a. Static algorithm approach
b. Weighted Round Robin

Q12: Compare Xenserver vs VMware with respect to the features like Guest O/S support, Backup facility, Thin provisioning, asset management and configuration mapping, dynamic resource allocation and failover, graphics support, licensing, host server management and storage specifications.

Q13: Explain the term VM(Virtual Machine) sizing. Also, discuss the two ways to do VM sizing, give suitable example for each.

Q14: Define a sensor with reference to an IoT device. Explain various characteristics of sensors. Also, mention and explain all classifications of sensors.

Q15: Briefly discuss any two (for each of the sector) Use Cases of IoT in the following sectors:
(a) Agriculture (b) Transportation

Q16: Discuss the following baseline technologies of IoT:

i. Security in IoT
ii. IoT Analytics
iii. IoT Processors
iv. IoT Standards and Ecosystems

Q17: Explain the following computing components used in laboratories of IoT/Cloud :

a. Arduino
b. Raspberry Pi

Q18: Discuss the following Service Delivery Models of Cloud, with an example for each:

a. Platform as a Service (PaaS)
b. Infrastructure as a Service (IaaS)
c. Software as a Service (SaaS)

Also, explore the features, benefits and relevant use cases for other service models like Security as a Service (SECaaS), Database as a Service (DBaaS), Analytics as a Service (AaaS) and API as a Service (APIaaS).

Q19: "Cloud Computing offers a variety of deployment models, a network connection viewpoint will be used to examine Cloud deployment models and their accessible components." With reference to this statement, discuss the following types of network connectivities:

a. Public Inter cloud Networking
b. Private Inter cloud Networking
c. Public Intra cloud Networking
d. Private Intra cloud Networking

Q20: Write short notes on the following:

a. Multi homing and its types
b. Horizontal scaling in cloud environment
c. Challenges in cloud computing
d. Applications of edge computing

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Course Code	**:**	**MCSL-228**
Course Title	**:**	**AI and Machine Learning Lab**
Assignment Number	**:**	**MCA_NEW(III)/L-228/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**30th April, 2026 (for January session)** **31st October, 2026 (for July session)**

This assignment has eight questions. Answer all the questions. The total marks for all the questions are 40, and the maximum marks for each question are mentioned. Your Lab Records will carry 40 Marks. The remaining 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the programme guide for the format of presentation.

Note: You must execute the program and submit the program logic, sample input, and output along with the necessary documentation. Assumptions can be made wherever necessary.

Q1: Write a Python Program to implement Depth First Search. **(4 Marks)**

Q2: Implement the Water Jug problem in Python. **(4 Marks)**

Q3: Write a Python Program to implement the Min-Max Algorithm. **(4 Marks)**

Q4: Write a Python Program to implement the Backtracking approach to solve the N Queens problem **(6 Marks)**

Q5: Discuss the Naïve Bayes algorithm and write the Python code to demonstrate the execution of the Naïve Bayes algorithm on the dataset of your choice. **(6 Marks)**

Q6: Implement multiple regression in Python. Take the dataset of your choice as input. **(4 Marks)**

Q7: Take a real-time example to implement the ID3 decision tree classification algorithm in Python. **(6 Marks)**

Q8: Write a Python Program to implement the Apriori algorithmona dataset of your own choice. **(6 Marks)**

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Course Code	**:**	**MCSL-229**
Course Title	**:**	**Cloud and Data Science Lab**
Assignment Number	**:**	**MCA_NEW(III)/L-229/Assign/2026**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**30th April, 2026 (for January session)** **31st October, 2026 (for July session)**

The assignment has two parts, A and B. Answer all the questions. Each part is for 20 marks. The lab records of the Cloud Computing Lab and Data Science Lab carry 20 Marks each. The remaining 20 marks are for viva voce. You may use illustrations, diagrams, and screenshots to enhance the explanations. Please go through the guidelines regarding assignments given in the MCA(New) Programme Guide for the format of the presentation. If any assumptions are made, please state them.

PART-I: Cloud Computing Lab

Q1: **(4+3+3 = 10 Marks)**

(a) Use Google Docs to create a document containing the guidelines for preparing and submitting the MCS-229 practical assignment. Store it on Google Drive and share it with five friends who can view and comment on the guidelines.

(b) Use Google Sheets to create a spreadsheet containing the cloud storage cost of any four cloud services. Store this cost as per the following headings:
Cloud Service; Web Address of Service; Space Required in GB; Cost per GB; Storage Cost; Discount, if any; Net Cost.
You may use the following formulas for making the spreadsheet:

Storage Cost = Space Required in GB * Cost per GB
Discount is computed as:
If Storage Cost < 1,00,000 Discount =0
For Storage Cost >= 1,00,000 but <5,00,000
Discount = 10% of Storage Cost
For Storage Cost >= 5,00,000
Discount = 25% of Storage Cost
Net Cost = Storage Cost– Discount

(c) Use Google Slides and prepare nine slides on the topic "Cloud Deployment Models" (Public, Private, Hybrid, Community) in a group of three students by sharing the Google Slides in your group in ***edit*** mode. Every group member should create three slides and contribute to the slides of other group members using the Google Slides.

Q2: **(5 Marks)**

Using the AWS Free Tier (trial version), explore Amazon S3 cloud storage and Amazon RDS services.

Q3: **(5 Marks)**

Use Google App Engine to write a program that finds the transpose of a given matrix. The program should accept matrix input, transpose it on the server, and display the resulting matrix. Deploy it on the Google Cloud.

PART-II: Data Science Lab

Q1: **(2+2+4+2 = 10 Marks)**

The weight of 50 students in the class was measured in Kilograms. The following table shows this data. Perform the tasks (i) to (iv) using R programming.

42	45	48	50	47	46	44	49	51	43
52	55	54	53	56	58	57	54	55	52
46	48	49	47	45	44	46	48	50	47
60	62	89	59	58	57	60	61	63	59
50	52	51	49	48	47	50	52	53	51

(i) Find the minimum and maximum weight.

(ii) Find the percentage of students whose weight is between 60 and 70 Kilograms.

(iii) Create and draw a frequency distribution using a relevant graph.

(iv) Find the outlier in the data.

Q2: **(10 Marks)**

An agricultural research organisation collected the following data on the quantity of fertiliser used in relation to the crop yield across ten different farms. Use R programming to fit a linear regression line to predict the effect of the use of fertiliser on the yield of the crop. Also, predict the yield of the farm that uses 75 kg of fertiliser per acre of the farm.

No.	Use of Fertiliser in (kg/acre)	Yield of Crop (quintals/acre)
1	40	18
2	45	20
3	50	22
4	55	24
5	60	20
6	48	21
7	65	29
8	58	25
9	42	19
10	70	32