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Roll No.....

P-11

Ph.D. Computer Applications I-Semester End Examinations (Aug. 2026)
Research Methodology (PC-CA-101A)

Time: 3 hrs.

Max. Marks: 60

Attempt 5 questions in all, selecting one question from each unit. Question no. 1 is compulsory. Each question carries 12 marks. **CANDIDATES ARE ALLOWED TO USE NON-PROGRAMMABLE CALCULATORS.**

Q.1	Marks
(a) What is meant by 'Research Gap' & 'Hypothesis'?	2
(b) What do you mean by 'Paradigmatic Shift/Change' in the context of research?	2
(c) Distinguish between 'Reproducibility' and 'Replicability'.	2
(d) What is the meaning of the term 'Simulation'; how is it different from 'Experimentation'?	2
(e) Define 'Correlation'. For which variables (out of deterministic variables and random variables) the correlation value is likely to be higher?	2
(f) What, if any, is(are) the difference(s) between 'References' and 'Bibliography'?	2

UNIT-I

Q.2(a)	What are the techniques for the review of literature? What are the sources for the same? What stage / phase follows the Literature Review phase?	8
Q.2(b)	How is research problem identification carried out?	4
Q.3(a)	Carry out a comparative analysis of the three philosophical approaches to research: 'positivism', 'interpretivism', and 'pragmatism'.	6
Q.3(b)	Briefly discuss the concepts, constructs and variables used in theory building.	6

UNIT-II

Q.4(a)	How is Research Design similar to a map and an architectural plan? Enumerate & briefly describe the features of a good Research Design.	8
Q.4(b)	Distinguish between deductive and abductive approaches to design.	4
Q.5	Explain the principles of Experimental Design & the basis of each principle.	12

UNIT-III

Q.6(a)	What are the techniques for each category (Probability & the Non-Probability Sampling), state the purpose & application areas of each technique.	6
Q.6(b)	Suppose the marks obtained out of 50 for a class of ten Ph.D. scholars in the subject Research Methodology are: 13, 15, 21, 24, 27, 30, 32, 35, 39, 46. Find mean, median, and standard deviation.	6
Q.7(a)	What are the considerations in sample size determination?	3

- Q.7(b)** Let study hours of a student be (X): 2, 4, 6, 8, 10; and his marks (Y): 20, 25, 30, 35, 40. Find correlation coefficient and regression equation of Y on X. **9**

UNIT-IV

- Q.8(a)** Suppose marks obtained (out of 40) by 8 students in a test are: 12, 15, 18, 20, 22, 25, 28, 30. Compute the mean and median of the marks. Also comment on whether the distribution of marks is symmetrical or skewed. **7**
- Q.8(b)** Describe three Statistical descriptors for the analysis of data. **5**
- Q.9(a)** Explain the structure of a doctoral thesis. Describe what each section / chapter should contain and what it should not. Shall the 'Abstract' have references cited in it? **8**
- Q.9(b)** Write a brief technical note on reference management tools. **4**

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Roll No.....

P-20

Ph.D. Computer Applications I Semester End Examinations (August 2026)
Cryptography & Network Security (PC-CA-110A)

Time- 3hrs

Max.Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1	Marks
(a) Differentiate between active attacks and passive attacks.	2
(b) What is meant by a polyalphabetic cipher?	2
(c) Define Public Key Infrastructure (PKI).	2
(d) What is the purpose of the SSH protocol?	2
(e) What is a Botnet?	2
(f) What is meant by Privacy-Enhancing Technologies (PETs)?	2

UNIT-I

Q.2(a)	Explain the security goals of cryptography. Illustrate each goal with one suitable real-life example.	6
Q.2(b)	Encrypt the plaintext "NETWORK" using the Vigenère Cipher with the key KEY . Show all intermediate steps.	6
Q.3(a)	Compare Symmetric Key Cryptography and Asymmetric Key Cryptography with respect to key management, speed, and application	6
Q.3(b)	Explain the working of the Monoalphabetic Substitution Cipher. Why vulnerable to frequency analysis?	6

UNIT-II

Q.4(a)	Explain the RSA algorithm with a neat flow diagram. Why is factorization of large numbers important in RSA security?	6
Q.4(b)	Discuss the concept of Digital Signatures. Explain how they provide authentication and non-repudiation.	6
Q.5(a)	Explain the Diffie-Hellman Key Exchange algorithm. How does it establish a shared secret over an insecure channel?	6
Q.5(b)	Differentiate between ECB, CBC, CTR, and GCM modes of operation. Mention one advantage and one limitation of each.	6

UNIT-III

Q.6(a)	Explain the architecture of SSL/TLS. Describe the steps involved in the TLS Handshake process.	6
Q.6(b)	Discuss the working of Firewalls and Intrusion Detection Systems (IDS). How do they complement each other?	6

- Q.7(a) Explain the Kerberos Authentication Protocol with a diagram. 6
- Q.7(b) Discuss the causes and impacts of DoS and DDoS attacks. Suggest suitable mitigation techniques. 6

UNIT-IV

- Q.8(a) Explain the concept of Blockchain. Discuss how blockchain ensures integrity and transparency. 6
- Q.8(b) Discuss the major security challenges in Internet of Things (IoT) environments and suggest suitable security measures. 6
- Q.9(a) Explain the concept of Homomorphic Encryption. Mention its advantages and applications. 6
- Q.9(b) Discuss the security risks associated with Artificial Intelligence Systems. Explain any three future research directions in AI security. 6

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P-12

Ph.D. Computer Applications I Semester End Semester Examinations (Aug 2026)
Machine Learning (PC-CA-102A)

Time- 3hrs

Max.Marks-60

Attempt 5 questions in all by selecting one question from each unit. Question 1 is compulsory and each Question carries 12 marks.

Q.1

Marks

- (a) State the functions performed by any 4 of the following methods of PANDA dataframe object: 2
- i) df.tail(), ii) df.shape
iii) df.columns iv) df.info()
v) df.describe() vi) drop()
- (b) Differentiate between underfitting and overfitting using the concepts of bias and variance. 2
- (c) Define an ANN. State its characteristics. 2
- (d) State the advantages and disadvantages of decision tree based ML models. 2
- (e) Differentiate between regression and classification. 2
- (f) Why Fuzzy Logic and ANN based models are termed as universal approximators. 2

UNIT-I

- Q.2(a) What is entropy in decision trees? State the formula for calculating entropy in a given sample of data. For the Fig 1 calculate (E (Outlook = Sunny)) 4
- Q.2(b) What is normal equation used in multiple linear regression? For the following data: 8

Student	Test Score x_i	Final Score y_i
1	60	70
2	70	65
3	80	70
4	85	95
5	95	85

- 1) What linear regression equation best predicts statistics performance, based on Test Score ?
- 2) If a student scored 75 in the test, what grade would we expect him to make in Final?
- Q.3(a) Explain how a confusion matrix is used to evaluate a classification model. What all information it can provide to a designer? 6

- Q.3(b)** Define data cleaning in the context of machine Learning. 6
- (a) Explain different techniques for handling missing values.
 - (b) What are outliers? Describe methods to detect and handle outliers.
 - (c) Explain the problem of imbalanced data and its impact on model performance.

UNIT-II

- Q.4(a)** State the K-Means Clustering Algorithm. Consider the following dataset: 7
- Data Points:** {2, 5, 4, 10, 14, 3, 12}
- For $K = 2$ evaluate the appropriate clusters. Perform clustering iterations and determine updated centroid positions. What can be concluded in the K-Means clustering algorithm if there is no change in centroid positions?
- Q.4(b)** Explain the concept of Hierarchical Clustering and describe its working procedure. 5
- Differentiate between agglomerative and divisive hierarchical clustering techniques with suitable example.
- Q.5(a)** Explain the working of BB-BC unconstrained global optimization algorithm. 6
- Q.5(b)** Write short note on Federated Learning. Why is it becoming popular? . 6

UNIT-III

- Q.6(a)** With the help of a block diagram explain the working of a fuzzy logic based system. 4
- Q.6(b)** With the help of an example compute and demonstrate how the following are evaluated in a fuzzy logic based system: 8
- a) Degree of compatibility
 - b) Depth of Firing
 - c) Implication
 - d) Aggregation
 - e) Weighted Average Defuzzification
- Q.7(a)** Discuss the various types of learning and their specific applications areas as used in machine learning. 4
- Q.7(b)** A fuzzy logic based machine learning model whose structure is shown in Fig.2, is required to be evolved from the given dataset. Design a suitable candidate solution encoding scheme that could be applied to evolve an optimal model using an unconstrained global optimization algorithm. 8

UNIT-IV

- Q.8(a)** Explain various applications of ANNs. How are ANNs being deployed in machine learning applications discuss with one example. 5
- Q.8(b)** What is Federated Machine Learning? With the help of a diagram explain the working of federated machine learning. 7
- Q.9(a)** With the help of diagram discuss the various steps of a single perceptron training algorithm. 5

Q.9(b) With the help of a suitable diagram discuss the training of MLP using Feed Forward Back Propagation algorithm. 7

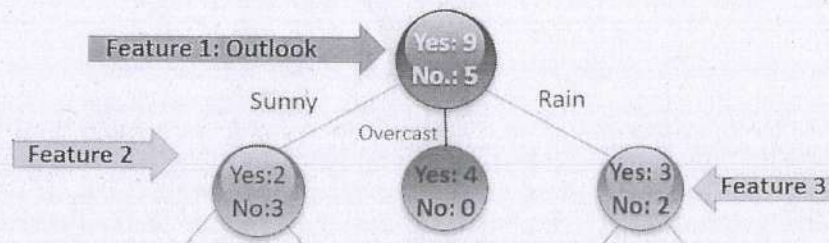


Fig:1

Structure of Fuzzy based Machine Learning Model to be evolved for optimal performance

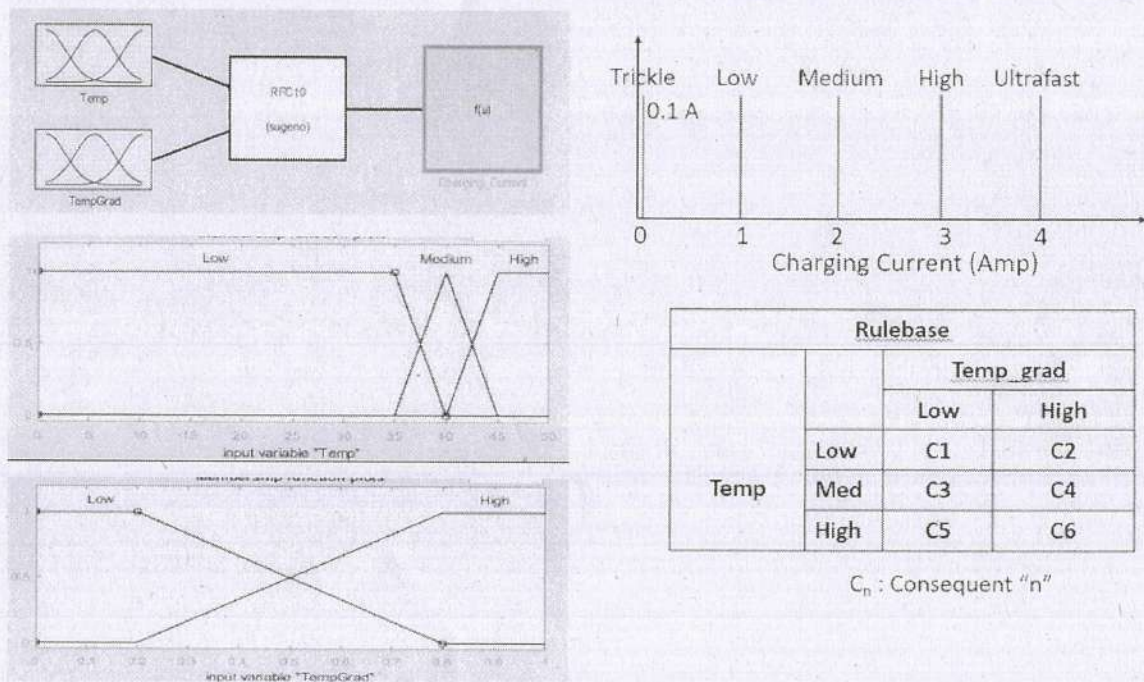


Fig 2