MACHINE INTELLIGENCE AND INTRODUCTION TO PYTHON
(ECEN 3233)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

    (i)   A technique that was developed to determine whether a machine could or could not demonstrate the artificial intelligence known as the_____.
    (a) Boolean Algebra   (b) Turing Test
    (c) Logarithm   (d) Algorithm

    (ii)   Knowledge when put into an action is called
    (a) information   (b) intelligence   (c) data   (d) wisdom.

    (iii)   Which rule is applied for the Simple reflex agent?
    (a) Simple-action rule   (b) Simple &Condition-action rule
    (c) Condition-action rule   (d) None of the above.

    (iv)   The PEAS in the task environment is about _____.
    (a) Peer, Environment, Actuators, Sense
    (b) Performance, Environment, Actuators, Sensors
    (c) Perceiving, Environment, Actuators, Sensors
    (d) None of the above

    (v)   The inference engine works on _____.
    (a) Forward Chaining   (b) Backward Chaining
    (c) Both (a) and (b)   (d) None of the above

    (vi)   In the uninformed search technique, time complexity
    (a) increases linearly   (b) decreases linearly
    (c) increases exponentially   (d) decreases exponentially.

    (vii)   In simulated annealing, the probability of going to a worse state is given by the
    (a) Metropolis function   (b) Dirac-Delta function
    (c) Eigen function   (d) Complementary error function.

(viii) Which of the following is true about Naive Bayes?
        (a) Assumes that all the features in a dataset are equally important
        (b) Assumes that all the features in a dataset are independent
        (c) Both (a) and (b)
        (d) None of the above options.

(ix)   In what type of learning labelled training data is used
        (a) unsupervised learning   (b) supervised learning
        (c) reinforcement learning   (d) active learning.

(x)   Which of the following is a disadvantage of decision trees?
        (a) Factor analysis
        (b) Decision trees are robust to outliers
        (c) Decision trees are prone to be overfit
        (d) None of the above.

Group - B

2. (a) Mention two normalization techniques that are used in data transformations.
                                                    [(CO1)(Remember/LOCQ)]
    (b) Consider a data set, D={34, 36,42, 48}. Apply a suitable normalization technique to map the data to a new range 0-1.   [(CO1)(Apply/IOCQ)]
    (c) Distinguish between 'data analytics' and 'data analysis'.
                                                    [(CO1)(Analyze/IOCQ)]
                                                    4 + 6 + 2 = 12

3. (a) Define completeness of an searching algorithm. Distinguish between informed and uninformed searching.   [(CO2)(Remember/LOCQ, Analyse/IOCQ)]
    (b) Explain the limitation of Hill Climbing algorithms. Follow Genetic algorithm to maximize $f(x) = x^2 - x$ with x interval $(1, 25)$, after two iterations.
                                              (CO2)(Analyse/IOCQ, Evaluate/HOCQ)]
                                                    (1 + 4) + (3 + 4) = 12

Group – C

4. (a) Classify propositions in the context of knowledge representation. Give suitable examples of each.   [(CO2)(Understand/LOCQ)]
    (b) What are the different quantifiers used in Predicate logic? Illustrate them with examples.   [(CO2)(Understand/LOCQ)]
    (c) Represent the following information using FOL
         (i)   Not all students like both Mathematics and Science.
         (ii) Every key can open some lock.   [(CO2)(Apply/IOCQ)]
                                                    4 + 4 + 4 = 12

5. (a) From the given rules and with the conclusion that Kapil is an all-rounder, determine the facts that can be asserted using reverse chaining.

Rule1: IF a player is good in bowling session AND excellent in batting, THEN he is an all-rounder.

Rule 2: IF a player gets 4 wickets in a session AND saves 20 runs during fielding THEN he is good in bowling session

Rule 3: IF the player is making century THEN he is excellent in batting.

[(CO3)(Evaluate/HOCQ)]

(b) State Beye's rule. [(CO2)(Remember/LOCQ)]

(c) Harry installed a new burglar alarm at his home to detect burglary. The alarm reliably responds at detecting a burglary but also responds for minor earthquakes. Harry has two neighbours David and Sophia, who have taken a responsibility to inform Harry at work when they hear the alarm. David always calls Harry when he hears the alarm, but sometimes he gets confused with the phone ringing and calls at that time too. On the other hand, Sophia likes to listen to high music, so sometimes she misses to hear the alarm. Here we would like to compute the probability of Burglary Alarm. Draw the Bayesian network. Calculate the probability that alarm has sounded, but there is neither a burglary, nor an earthquake occurred, and David and Sophia both called Harry using the Bayesian network. Given

Burglary (B)		Earthquake (E)	
T	0.002	T	0.001
F	0.998	F	0.999

Alarm (A)			
B	E	P(A=T)	P(A=F)
T	T	0.94	0.06
T	F	0.95	0.05
F	T	0.69	0.31
F	F	0.001	0.999

David Calls (D)		
A	P(D=T)	P(D=F)
T	0.91	0.09
F	0.05	0.95

Sophia Calls (S)		
A	P(S=T)	P(S=F)
T	0.95	0.05
F	0.04	0.96

[(CO3)(Evaluate/HOCQ)]
5 + 2 + (2 + 3) = 12

Group - D

6. (a) Illustrate the Different Types of Machine Learning methods? What are the differences between Machine Learning and Deep Learning?
[(CO4)(Remember/LOCQ, Analysis/IOCQ)]

(b) What are Support Vectors in SVM? Name the Different Kernels in SVM.
[(CO4)(Remember/LOCQ)]

(c) Identify the limitations of SVM. [(CO5)(Apply/IOCQ)]
(3 + 3) + (2 + 2) + 2 = 12

7. (a) Explain what is k-Means Clustering. What are some Stopping Criteria for k-Means Clustering? [(CO4) (Analysis/IOCQ)]

(b) Highlight the main difference between k-Means and k-Nearest Neighbours.
[(CO4) (Analysis/IOCQ)]

(c) Compare Hierarchical Clustering and k-Means Clustering.
[(CO4)(Analysis/IOCQ)]
(2 + 2) + 4 + 4 = 12

Group - E

8. (a) Explain the Identifiers, Keywords, Statements, Expressions, and Variables in Python programming language with examples.   [(CO5)(Evaluate/HOCQ)]
   (b) Illustrate the different types of control flow statements available in Python with flowcharts.   [(CO5)(Evaluate/HOCQ)]
   (c) Give information about the basic data types available in Python.
                                                [(CO5)(Remember/LOCQ)]
   5 + 5 + 2 = 12

9. (a) What is data pre-processing in machine learning in python? Name the categories of Machine Learning Algorithms with Python.
                                    [(CO5&CO6)(Remember/LOCQ)]
   (b) Write short note on Scikit learning, NumPy and Scipy.
                                    [(CO5,CO6)(Remember/LOCQ)]
   (3 + 3) + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	37.5	37.5	25

Course Outcome (CO):

After the completion of the course students will be able to
1. Evaluate of Machine Intelligence (MI) methods and its foundations.
2. Apply basic principles of machine intelligence in solutions that require problem solving,perception, knowledge representation, and learning.
3. Show the importance of MI and planning in solving real world problems.
4. Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information also to show how the searching algorithms playing vital role in problem solving.
5. Learn and understand the basics of the Python Programming Language.
6. Design simple software to experiment using Python with various MI concepts.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question