



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, December 2021**

**Course: Introduction to Artificial Intelligence**  
**Program: B Tech AI & ML**  
**Course Code: CSAI 2007**  
**Instructions: Attempt all the questions.**

**Semester: III**  
**Time: 03 hours**  
**Max. Marks: 100**

**SECTION A**  
**(Scan and Upload)**

(5Qx 4M = 20 Marks)

Q1	Define Artificial Intelligence (AI). Differentiate between strong AI and Weak AI.	4	CO1
Q2	Show that $[p \wedge (p \rightarrow q)] \rightarrow q$ is a tautology.	4	CO2
Q3	A die is thrown twice and the sum of the numbers appearing is observed to be 6. Find the conditional probability that the number 4 has appeared at least once?	4	CO3
Q4	Differentiate Biological Neurons and Artificial Neural Networks.	4	CO3
Q5	Write the four major steps involved in the machine learning process.	4	CO4

**SECTION B**  
**(Scan and upload)**

(4Qx10M = 40 Marks)

Q1	State and prove the Bayes' Theorem. Given that probability of the statement, 'John has a viral' is 0.20, the probability of John being observed sneezing when he had viral is 0.8, and the probability of John being observed sneezing when he did not have viral is 0.2. Find the probability of John having viral if he is seen sneezing.	10	CO3
Q2	(a) Draw an architectural diagram of the McCulloch-Pitts neuron model. Write Characteristics of McCulloch-Pitts artificial neural network. (b) The input to a single-input neuron is 2.0, its weight is 2.3, and its bias is -3. It has a linear transfer function. i. What is the net input to the transfer function? ii. What is the neuron output?	5+5=10	CO3
Q3	(a) State the process of usability of the cross-validation technique in a machine learning algorithm. (b) How do you evaluate a machine learning algorithm using k-fold cross-validation on a dataset? Explain with example.	5+5=10	CO4
Q4	Find the equation of the regression line for the number of hours 5 different students watched television during the weekend and the scores of each student who took a mid-term test the	5*2=10	CO4

following Monday. Use the equation to find the expected mid-term test score for a student who watches 10 hours of TV.

Hours, $x$	2	3	4	4	5
Mid-term test score, $y$	25	20	15	10	5

**OR**

Explain the process of splitting in a Decision tree. How does the tree determine which variable to break at the root node and its child nodes?

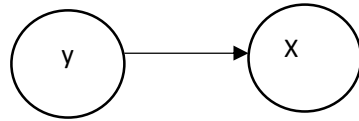
**SECTION-C**  
**(Scan and upload)**

(2Qx 20M= 40 Marks)

Q1	<p>(a). Use the rules of inference to construct a valid argument showing that the conclusion, “Someone who passed the first exam has not read the book.” follows from the premises:</p> <ul style="list-style-type: none"> <li>I. “A student in this class has not read the book.”</li> <li>II. “Everyone in this class passed the first exam.”</li> </ul> <p>(b). Consider the following knowledge base and the goal: it-will-rain. Prove by resolution theorem that the goal is derivable from the knowledge base</p> <ul style="list-style-type: none"> <li>I. The humidity is high, or the sky is cloudy.</li> <li>II. If the sky is cloudy, then it will rain.</li> <li>III. If the humidity is high, then it is hot.</li> <li>IV. It is not hot.</li> </ul> <p><b>OR</b></p> <p>(a). Define the Knowledge base. Discuss components of the Knowledge-based system. How the knowledge base plays its role in developing the expert system? Explain.</p> <p>(b). Discuss the Wumpus world problem in AI and its rules for inference.</p>	<b>10*2=20</b>	<b>CO2</b>
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Q2	<p>Consider the following Bayesian network, where X = having the flu and Y= coughing:</p> <div style="text-align: center;"> <pre> graph LR     X((X)) --&gt; Y((Y))     </pre> </div>	<b>5*4=20</b>	<b>CO3</b>
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- (a) Write down the joint probability table specified by the Bayesian network.
- (b) Determine the probabilities for the following Bayesian network.



(c) Which Bayesian network would you have specified using the rules learned in class?

(d) Are Y and X independent in the given Bayesian network?