Name: **Enrolment No:**	

UPES

End Semester Examination, December 2024

Course: Artificial Intelligence **Semester: V**

Program: Bachelor of Computer Application in CSF **Time : 03 hrs.**

Course Code: CSAI3019 **Max. Marks: 100**

Instructions: Please attempt according to the provided time and given weightage.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Describe the key components of a **Production System** in Artificial Intelligence, focusing on: (i) The structure and function of rules (conditions and actions), (ii) The role of the knowledge base or database, (iii) The significance of the **control strategy**, (iv) The purpose and operation of the rule interpreter or executor.	**4**	**CO1**
Q 2	Using labelled diagrams, explain the problems of local maxima and plateaus in the Hill Climbing Algorithm in no more than 20 words each.	**4**	**CO1**
Q 3	State the syntax of a **rule** in the context of expert systems. Explain the role of the keywords **AND** and **OR** in constructing a rule.	**2+2**	**CO4**
Q 4	Draw the basic structure of an expert system and label its different components.	**4**	**CO3**
Q 5	Define an expert system shell in about 30-40 words.	**4**	**CO3**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	Consider a scenario of the Speech Act: **"John asks Mary where the screwdriver is."** The precondition for this speech act are: i) John knows where Mary is. ii) Mary knows the value of "where the screwdriver is." iii) Mary is willing to inform John about "where the screwdriver is." The postcondition is: i) John learns the value of "where the screwdriver is." For the above scenario, perform the following tasks: a) Represent the speech act using an appropriate model operator.	**2+6+2**	**CO4, CO2**

	b) Represent each of the preconditions of the speech act using the appropriate model operators. c) Denote the postcondition of the speech act using the appropriate model operator.		
Q 7	Consider a scenario of the Speech Act: **"Mary tells John that the screwdriver is in the toolbox."** The precondition for this speech act are: i) Mary believes that "the screwdriver is in the toolbox" is True. ii) Mary knows where John is located. The postconditions are: i) John believes that Mary believes "the screwdriver is in the toolbox" is True. ii) If John trusts Mary, then John will also believe that "the screwdriver is in the toolbox" is True. For the above scenario, perform the following tasks: a) Represent the speech act using an appropriate model operator. b) Represent each of the preconditions of the speech act using the appropriate model operators. c) Similarly, denote each of the postconditions of the speech act using the appropriate model operators.	**2+4+4**	**CO4, CO2**
Q 8	To understand larger linguistic units like texts and dialogues, it's essential to examine the relationships between phrases and sentences. These relationships help connect ideas and clarify meaning across multiple sentences. For example, the following sentences demonstrate an "Identical Entities" relationship in discourse. **Example:** "Bill had a red balloon." "John wanted it." Without context, the word **"it"** could refer to anything, but the discourse reveals that **"it"** refers to the **"red balloon"**. Identify **two** relationships commonly found in discourse. For each, name the relationship type and describe it in a single line (around 20 words), providing suitable examples similar to the one above.	**5+5**	**CO4, CO2**
Q 9	Consider a scenario: **"John's goal is finding a screwdriver to accomplish a higher goal of assembling the bike to put together before the Christmas Eve."** a) In the above scenario, identify the different **phrases** that are to be used as parameters in representing the modal operator USE().	**3+1+6**	**CO4, CO2**

	b) Represent how a person uses tools or resources such as the screwdriver to achieve the task in the above mentioned scenario using the model operator USE(). c) Provide the preconditions and the postcondition involved in the USE() operator. **OR** Consider a scenario: **"John is searching for the screwdriver, so he can use it to assemble the bike."** a) In the above scenario, identify the different **phrases** that are to be used as parameters in representing the modal operator LOOK-FOR(). b) Represent the above mentioned scenario using the model operator LOOK-FOR(). c) Provide the preconditions and the postcondition involved in the LOOK-FOR() operator.	**4+2+4**	**CO4, CO2**
SECTION-C (2Qx20M=40 Marks)			
Q 10	State the meaning of machine learning from labelled and unlabelled data. Establish the relationship between these concepts and supervised and unsupervised learning. Show this difference with the help of an example for each. Draw a labelled diagram of a perceptron learning model including the following components: a) Activation function and output (y) b) Weights and bias c) Features (X_1, X_2, X_3). Describe each component in no more than 15 words. **OR** Write the equation for the output of a simple perceptron model using a step function as its activation function. Explain at least two reasons why a bias term is needed in a perceptron learning model. Identify one drawback of using a step function in a perceptron model and suggest a solution to overcome it. Define the activation function used in a sigmoid neuron and include a suitable plot of the sigmoid function.	**4+2+4+5+5** **4+4+4+8**	**CO3** **CO3**
Q 11	Consider a simple medical diagnosis expert system with the following set of available rules: **Rule 1**: If a patient has a high fever and a sore throat, then they might have the flu. **Rule 2**: If a patient has a sore throat and a cough, then they might have a cold. **Rule 3**: If a patient has chills, then, likely have a high fever.	**10+10**	**CO3, CO4, CO2**

	Rule 4: If a patient has body aches, then likely have the flu. **Facts:** Given initial facts are: • The patient has chills. • The patient has sore throat. • The patient has body aches. (1) Using the **forward chaining inference technique** determine if a patient has "Flu." (2) Consider the following production rules: **Production Rules:** **S → NP VP** **NP → ART NP1 | PRO | PN | NP1** **NP1 →ADJS N** **ADJS → ε | ADJ ADJS** **VP → V | V NP** **N → report | document | system** **PN → Alice | John** **PRO → she | he | I** **ART → a | an | the** **ADJ → short | long | fast | slow** **V → reviewed | checked | updated** Create a top-down parse tree for the sentence "**Alice checked the report.**"		