Section A: Multiple Choice Questions (30 Marks)

Part I: (10 Marks)

First Order Logic (5 Questions):

1. Which of the following cannot be represented in propositional logic but can be represented in FOL?
   a) All birds can fly
   b) It is raining
   c) Either it is sunny or windy
   d) It is hot and humid

2. What does the expression ∀x loves(Mary, x) mean?
   a) Mary loves herself
   b) Everyone loves Mary
   c) Mary loves everyone
   d) Nobody loves Mary

3. Which is a correct representation for: "Someone is laughing"?
   a) ∀x laughing(x)
   b) ¬∃x laughing(x)
   c) ∃x laughing(x)
   d) ¬∀x laughing(x)

4. What does the quantifier duality principle state?
   a) ∃x is not the same as ∀x
   b) ∀x ¬P(x) ≡ ¬∃x P(x)
   c) ∃x P(x) ≡ ∀x P(x)
   d) ∃x P(x) ≡ ∃x ¬P(x)

5. Which of the following correctly expresses: "Nobody loves George"?
   a) ∀x loves(x, George)
   b) ∃x ¬loves(x, George)
   c) ¬∃x loves(x, George)
   d) ∀x ¬loves(George, x)

Expert System Schemas (5 Questions):

6. The inference engine in an expert system is responsible for:
   a) Acquiring knowledge
   b) Drawing conclusions
   c) Explaining output
   d) Editing the knowledge base

7. Which of the following is *not* a core component of an Expert System?
   a) User Interface
   b) Compiler
   c) Knowledge Base
   d) Inference Engine

8. The rule "IF fever AND cough THEN flu" is an example of:
   a) Forward chaining

b) Rule base
c) Question base
d) Fact base

9. In an ES, what is stored in the *fact base*?
   a) Logical rules
   b) Predicates
   c) User queries
   d) Values for propositions

10. The main goal of the *Explanation System* in an expert system is to:
    a) Modify the interface
    b) Provide reasoning steps
    c) Store new data
    d) Evaluate user input

Part II: (20 Marks)

General Knowledge Representation and Inference (20 Questions)

11. In a semantic network, what does a node represent?
    a) Rules
    b) Inference
    c) A concept
    d) An attribute

12. The "is-a" relation in semantic networks implies:
    a) Instance checking
    b) Hierarchical classification
    c) Value assignment
    d) Data flow

13. Which component of semantic networks supports default inheritance?
    a) Slots
    b) Rules
    c) Labels
    d) Nodes

14. What type of semantic network allowing the inference of new knowledge ?
    a) Assertional
    b) Implicational
    c) Executable
    d) Hybrid

15. Which is an application of semantic networks in AI?
    a) Grammar checking
    b) Software installation
    c) NLP
    d) Game graphics

16. What is an advantage of semantic networks?
    a) Expressiveness
    b) Scalability
    c) Intuitive representation
    d) Unstructured data storage

17. Frames are primarily used to represent:
    a) Code
    b) Mathematical models
    c) Stereotyped situations
    d) Programming logic

18. In a frame, the attributes of a concept are known as:
    a) Tags
    b) Nodes
    c) Slots
    d) Values

19. What does the "IF-NEEDED" procedural attachment in frames do?
    a) Overrides inherited slots
    b) Triggers when a slot is accessed
    c) Deletes default values
    d) Connects to another frame

20. What type of semantic network to represent procedural knowledge?
    a) Assertional
    b) Implicational
    c) Executable
    d) Hybrid

21. Which of the following is *not* a key element of ontology?
    a) Slots
    b) Classes
    c) Instances
    d) Relations

22. Ontologies help improve semantic search by:
    a) Enhancing formatting
    b) Organizing keywords alphabetically
    c) Providing concept context
    d) Increasing data storage

23. A system reasoning from "All mammals are warm-blooded" and "All dogs are mammals" to infer "Dogs are warm-blooded" is an example of:
    a) Backward chaining
    b) Forward chaining
    c) Constraint logic
    d) Recursive programming

24. Which knowledge representation supports reasoning and formal logic best?
    a) Semantic networks

b) Frames
c) Ontologies
d) Trees

25. In ontologies, what is used to represent rules and constraints?
    a) Attributes
    b) Axioms
    c) Classes
    d) Individuals

26. Frame-based systems often simulate human reasoning in:
    a) Finance
    b) Game development
    c) Cognitive modeling
    d) Robotics

27. Which type of rule in semantic networks maps synonyms?
    a) Constraint
    b) Equivalence
    c) Classification
    d) Default

28. What component helps semantic networks understand path length and concept similarity?
    a) Nodes
    b) Attributes
    c) Semantic Distance
    d) Frames

29. Which KR method is best suited for large, structured domains like healthcare?
    a) Frames
    b) Ontologies
    c) Trees
    d) Decision tables

30. What would best represent "A car has wheels and an engine" in a semantic network?
    a) Predicate logic
    b) Equivalence rule
    c) Has-A relationship
    d) Class instance

✍ Section B: Written Questions (20 Marks)

Q1: Frame-Based Representation (10 Marks)
Draw a frame hierarchy representing the following:

- Parent Frame: **ElectronicDevice** with slots: powerSupply, warrantyPeriod (default = 12 months)

- Child Frame: **TV** inherits from ElectronicDevice and adds: screenSize, modelNumber

- Further child: **SmartTV**, adds: hasWiFi, operatingSystem

- Create an instance of SmartTV: model number "X100", screen size = 55", WiFi = Yes, OS = Android

Instructions: Clearly show the inheritance structure and slot values in diagram form.

Q2: Semantic Network or Ontology (10 Marks)
Draw a semantic network or ontology based on this scenario:

- A person named JohnDoe wants to build muscle.

- He is at an advanced fitness level.

- He is assigned to WorkoutPlanA, which includes PushUps.

- PushUps are strength training and high intensity.

Instructions: Use concepts like: Person, Goal, Exercise, WorkoutPlan, IntensityLevel.
Label relationships (e.g., "hasGoal", "assignedPlan", "includesExercise").