**CS6659 ARTIFICIAL INTELLIGENCE**

**UNIT I**

**INTRODUCTION TO Al AND PRODUCTION SYSTEMS**

Introduction to AI-Problem formulation, Problem Definition Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing Heuristic functions -Hill Climbing Depth first and Breath first Constraints satisfaction Related algorithms, Measure of performance and analysis of search algorithms

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| **Category** | **Topics** | **Question Paper Year** | **Questions** |
| **Part A** | Production systems, Control strategies, Search strategies.  Problem solving methods- Heuristic functions  Hill Climbing  Depth first and Breath first Constraints satisfaction | April/May 2016 | 1. What is ridge? 2. How much knowledge would be required by a perfect program for the problem of playing chess? Assume that unlimited computing power is available? |
| Nov/Dec 2016 | 1. What is heuristic function? 2. What are the categories of production systems |
| April/May 2017 | 1. List down the characteristics of intelligent agent 2. List some of the uninformed search techniques. |
| Nov/Dec 2017 | 1. State the advantages of Breadth First Search.  2. What is Commutative production system? |
| April /May 2018 | 1. Will Breadth –First Search always find the minimal solution. Why? 2. What is monotonic production system |
| **PART B** | Problem solving methods- Heuristic functions  Hill Climbing**,** Depth first and Breath firstConstraints satisfaction | April/May 2016 | 1. (i) Explain the Heuristic functions with examples(6)   (ii)Write the algorithm for Generate and Test.(10)  2. Solve the given problem. Describe the operators involved in it  Consider a Water Jug Problem. You are given with two jugs ,a 4 gallon jug and a 3 gallon jug .Neither has any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 gallons of water into 4 gallon jug? |
| Nov/Dec 2016 | 1. (i)Exemplify the necessary components to define an AI problem with an example.(6)   (ii) Consider a Water Jug Problem. You are given with two jugs ,a 4 gallon jug and a 3 gallon jug .Neither has any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 gallons of water into 4 gallon jug?(10)   1. (i)Write the algorithm for steepest ascent hill climbing(4)   (ii) Explain DFS algorithm with an example.(8)  (iii)State the characteristics of an AI problem.(4) |
| April/May 2017 | 1. Explain informed search strategies with an example. 2. Explain the process of simulated annealing with example |
| Nov/Dec 2017 | 1. Explain the following types of Hill Climbing search techniques.   i) Simple Hill Climbing.  ii) Steepest-Ascent Hill Climbing.  iii) Simulated Annealing.   1. Discuss Constraint Satisfaction problem with an algorithm for solving a Crypt arithmetic problem. |
| April /May 2018 | 1. Consider the blocks World Problem with four blocks A,B,C,and D with the start and goal states given below  |  | | --- | | A | | D | | C | | B |   Initial State   |  | | --- | | D | | C | | B | | A |   Goal State  Assume the following teo operations Pick and a block and put it on table ,pick up a block and put it on another block. Solve the above problem using Hill Climbing algorithm and a suitable heuristic function. Show the intermediate decisions and states   1. List and describe the problem characteristics that need to be considered for selecting appropriate heuristics for a given class of problems |

**UNIT II**

**REPRESENTATION OF KNOWLEDGE**

Game playing Knowledge representation, Knowledge representation using Predicate logic Introduction to predicate calculus, Resolution Use of predicate calculus, Knowledge representation using other logic -Unification Structured representation of knowledge

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| **Category** | **Topics** | **Question Paper Year** | **Questions** |
| **Part A** | Game playing- Knowledge representation using Predicate logic- Use of predicate calculus | April/May 2016 | 1.What is alpha beta pruning  2. For the given sentence “All pompeans were Romans”  Write a well formed formula in predicate logic |
| Nov/Dec 2016 | 1. What is alpha beta pruning. 2. List the two levels of Knowledge representation. |
| April/May 2017 | 1. Differentiate propositional logic and predicate logic. |
| Nov/Dec 2017 | 1. Convert the following into Horn clauses.   Vx: Vy: cat(x) v fish (V) -+ Iikes - to - eat(x, y) |
| April /May 2018 | 1. Write the following in a predicate logic:   For all x and y, if x is a parent of y then y is a child of x.  2. List any three methods to select an initial structure knowledge representation. |
| **PART B** | Game playing  Resolution- Unification | April/May 2016 | 1. Covert the following well formed formula into clause form with sequence of steps.   Vx:[Roman(x)^Know(x,Marcus)]  -->[hate(x,ceasar)v(Vy€z:hate(y,z)->thinkcrazy(x,y))]  2.(i)Write the resolution procedure for prepositional logic.  (ii)Explain the Iterative Deepening algorithm |
| Nov/Dec 2016 | 1. Explain resolution in predicate logic with suitable example. 2. Consider the following sentences.  * John likes all kinds of food. * Apples are food. * Chicken is food. * Anything anyone eats and isn’t killed by is food. * Bill eats peanuts and is still alive. * Sue eats everything Bill eats.  1. Translate these sentences into formulae in predicate logic(10) 2. Convert the above FOL into clause form(6) |
| April/May 2017 | 1. Explain Minimax algorithm in detail.  2. Explain Alpha-Beta Pruning and Alpha –Beta algorithm. |
| Nov/Dec 2017 | 1. Consider the following sentences.  * John likes all kinds of food. * Apples are food. * Chicken is food. * Anything anyone eats and isn’t killed by is food. * Bill eats peanuts and is still alive. * Sue eats everything Bill eats.   (a)Translate these sentences  into formulae in predicate logic(10)  (b)Convert the above FOL into clause form(6)  2.Trace the operation of the unification algorithm on each of the following pairs of literals  (i) f(Marcus and f(Caesar)  (ii) f(x) and f(g(y))  (iii)F(Marcus,g(x,y)) and f(x,g(Caesar,Marcus)) |
| April /May 2018 | 1. Consider the following facts.   -Steve only likes easy courses  -Science courses are hard.  - All the courses in the HaveFun department are easy  -BK301 is a HaveFun department course  Use resolution to answer the question “What course would Steve like”?   1. Consider a two player game in which the minimax search procedure is used to compute the best moves for the first player. Assume a static evaluation function that returns values ranging from -10 to 10,with 10 indicating a win for the first player and -10 a win for the second player .Assume the following game tree in which the static scores are from the first player’s point of view. Suppose the first player is the maximizing player and needs to make the next move. What move should be chosen at this point? can the search be optimized.   A  D  C  B  G  E  9  K  J  I  H  F  -6 0 0 -2  -4 -3 |

**UNIT III**

**KNOWLEDGE INFERENCE**

Knowledge representation -Production based system, Knowledge representation-Frame based system. Inference - Backward chaining, Inference -Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory- Bayesian NetworkDempster - Shafer theory

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| **Category** | **Topics** | **Question Paper Year** | **Questions** |
| **Part A** | Production based system, Knowledge representation-  Frame based system.  Inference - Backward chaining, Inference -Forward chaining Bayesian Theory | April/May 2016 | 1. What is Bayesian Networks 2. Write the properties of fuzzy sets |
| Nov/Dec 2016 | 1. What are fuzzy sets. 2. List the properties fo Fuzzy sets |
| April/May 2017 | 1. Define forward and backward chaining. Differentiate the same 2. Define meta rules 3. Give the Bayes ‘s rule equation. |
| Nov/Dec 2017 | 1. Differentiate forward and backward reasoning.  2. Define Fuzzy reasoning.  3. Compare production based system with frame based system. |
| April /May 2018 | 1. Given that P(A)=0.3 P(A/B)=0.4 and P(B)=0.5 ,Compute P(B/A)=? 2. How does forward chaining differs from backward chaining? |
| **PART B** | Backward chaining, -Forward chaining,  Bayesian Theory- Bayesian Network  Dempster - Shafer theory  Fuzzy reasoning | April/May 2016 | 1.(a)Briefly explain how reasoning is done using fuzzy logic(6)  (b)Explain Dempster-Shafer Theory(10)  2. What is Forward Chaining and how does it work? Explain the forward Chaining algorithm with an example. |
| Nov/Dec 2016 | 1. Explain in detail about forward chaining and backward chaining with algorithms 2. What is Dempster Shafer Theory? Explain wit suitable examples |
| April/May 2017 | 1. Explain in detail about forward chaining and backward chaining with an example 2. Explain about Dempster Shafer Theory |
| Nov/Dec 2017 | 1.Explain the production based knowledge representation technique.  2. (i) Discuss about Bayesian Theory and Bayesian Network. (6)  ii) Describe in detail about Dempster-Shafer theory. (7) |
| April /May 2018 | 1. Discuss the need and structure of Bayesian networks 2. How are the frames used in knowledge representation? Give the structure of a general frame |

**UNIT IV**

**PLANNING AND MACHINE LEARNING**

Basic plan generation systems -Strips -Advanced plan generation systems –K strips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning. Adaptive Learning

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| **Category** | **Topics** | **Question Paper Year** | **Questions** |
| **Part A** | Basic plan generation systems -Strips. Learning- Machine learning | April/May 2016 | 1. What is rote learning? 2. Brief frame problem. |
| Nov/Dec 2016 | 1. What are the different types of planning 2. Write the difference between supervised learning and unsupervised learning |
| April/May 2017 | 1. What are the differences and similarities between problem solving and planning?  2. What are the different types of planning. |
| Nov/Dec 2017 | 1. Define adaptive learning 2. What is hierarchical planning? |
| April /May 2018 | 1. Define machine learning 2. When is a why explanation better than how explanation |
| **PART B** | Basic plan generation systems -Strips Machine learning. Adaptive Learning | April/May 2016 | 1 (i)Describe the components of a planning system  (ii)What is ID3? Write the drawback of ID3.  2. (i)Describe the Hierarchical planning method with an example.  (ii)Describe the Learning with Macro-Operators. |
| Nov/Dec 2016 | 1. (i)Describe hierarchical planning method with an example.   (ii)Describe learning with macro –operators   1. (i)Explain the various types of learning in problem solving   (ii)Explain learning in Decision Tree with example |
| April/May 2017 | 1. Discuss in detail the process of machine learning with example 2. Explain in detail the STRIPS. |
| Nov/Dec 2017 | 1. Write short notes on the   (i)Learning by Parameter Adjustment  (ii)Learning with Macro-Operators.  (iii)Learning by Chunking   1. Write down STRIPS style operators that correspond to the following blocks world description.  |  | | --- | | A | | B |   ON(A,B,S0)  ONTABLE(B,S0)  CLEAR(A,S0)  (ii)Write short notes on Nonlinear Planning using Constraint Posting   1. Analyse any two machine learning algorithms with an example. |
| April /May 2018 | 1. Discuss planning methodology used by STRIPS in detail. 2. Discuss the various types of machine learning with appropriate examples |

**UNIT V  
 EXPERT SYSTEMS**

Expert systems Architecture of expert systems, Roles of expert systems -Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN DART, XCON, Expert systems shells.

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| **Category** | **Topics** | **Question Paper Year** | **Questions** |
| **Part A** | Expert systems MYCIN XCON, Meta knowledge | April/May 2016 | 1. What is meta knowledge? How meta knowledge is represented in rule-based expert systems? 2. Write any four earliest expert systems. |
| Nov/Dec 2016 | 1. Define an expert system  2. What is XCON? |
| April/May 2017 | 1. List out the problem areas addressed by expert systems 2. What are the advantages of the MYCIN |
| Nov/Dec 2017 | 1.List the characteristic features of expert system  2. What is MOLE? |
| April /May 2018 | 1. What are the common mechanisms supported in an expert system shell 2. List the three activities supported by the programs that interact with domain experts to extract expert knowledge |
| **PART B** | Architecture of expert systems, Knowledge Acquisition, – MYCIN DART, XCON, , Expert systems shells. | April/May 2016 | 1. (i) Explain about the Knowledge acquisition.   (ii)Write the characteristic features of Expert systems.   1. (i)Explain the basic components of an expert system   (ii)Write any six applications of expert systems. |
| Nov/Dec 2016 | 1. (i)Explain about the Knowledge acquisition   (ii)Brief any six applications of expert systems.   1. Explain with neat diagram the architecture of expert system and mention its features. |
| April/May 2017 | 1. Define Expert System. Explain the architecture of an expert system in detail with a neat diagram and an example. 2. Explain the need, Significance and evolution of XCON expert system. |
| Nov/Dec 2017 | 1. Design an expert system for Travel recommendation and discuss its roles. 2. Explain the expert system architectures:   (i)Rule-based system architecture  (ii)Associative or Semantic Network Architecture  (iii)Network architecture  (iv)Blackboard System Architecture   1. Explain the following expert systems.   (i)MYCIN  (ii)DART |
| April /May 2018 | 1. Write a detailed note about the MYCIN expert system and its functioning 2. Write a detailed note an expert systems including representation, Usage of domain knowledge, reasoning and explaining |