CBCS SCHEME

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21CS51

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Automata Theory and Compiler Design

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

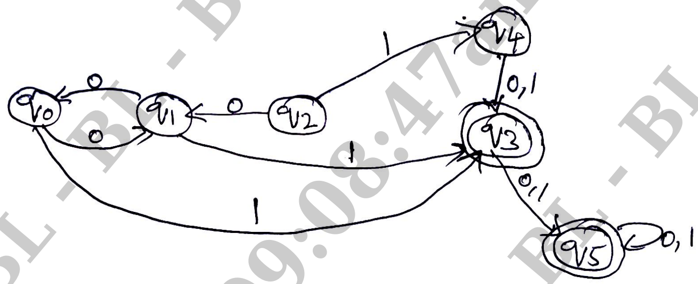
1 a. Define the three basic concepts of Automata. Also construct a DFA that accepts all strings that have the first and last letter different on Σ = {a, b}. Justify the DFA with example. **(10 Marks)**

b. Solve by converting the following NFA to DFA. **(10 Marks)**

OR

2 a. Explain the different phases of a compiler with neat block diagram and convert the source code. Position = Initial + rate * 60 into target code. **(10 Marks)**

b. Solve by Minimizing the following DFA. **(10 Marks)**



Module-2

3 a. Define the formal definition of Regular expression. Also write the regular expression for the following : i) Set of strings consisting of Even numbers of ‘a’ s followed by odd number of ‘b’s on Σ = {a, b}.
ii) $L = \{a^n b^m : (n + m) \text{ is even}\}$.
iii) $L = \{a^n b^m : n \geq 4 ,\ m <= 3\}$. Justify the answer. **(10 Marks)**

b. Explain Input buffering in Lexical Analyzer. Define Token , Patterns and Lexemes with examples. Also write the tokens for E = m * c * * 2. **(10 Marks)**

OR

4 a. Define Regular Definitions. Write the Regular Definitions for ‘C’ identifiers and unsigned numbers using short hands notations and write the transition diagram. **(10 Marks)**

b. State and prove pumping lemma theorem for Regular languages. **(10 Marks)**

Module-3

5 a. Define Context free grammar. Write a CFG for the following :
i) To generate strings of palindrome over Σ = {0, 1}.
ii) $L = \{a^i b^j \mid i \neq j ,\ i \geq 0 \text{ and } j \geq 0\}$
iii) $L = \{0^m 1^m 2^n \mid m \geq 1\ \xi\ n \geq 0\}$. Justify the answer. **(10 Marks)**

b. Define Left recursion and left factoring. Also remove the left recursion and left factoring for the Grammar $E \rightarrow E + T \mid T$
$T \rightarrow id \mid id [\ ] \mid id [X]$
$X \rightarrow E, E \mid E.$ **(10 Marks)**

OR

6 a. Define Ambiguous grammar. Show that the following in ambiguous. **(10 Marks)**

$S \rightarrow iCtS \mid iCtSeS \mid a$
$C \rightarrow b$ for the string ibtibtaea

b. Consider the grammar
$E \rightarrow T\ E'$
$E' \rightarrow + TE' \mid \in$
$T \rightarrow F\ T'$
$T' \rightarrow * F\ T' \mid \in$
$F \rightarrow (E) \mid id$
i) Compute FIRST and Follow sets.
ii) Using FIRST and Follow sets construct the Predictive LL (1) parsing table. **(10 Marks)**

Module-4

7 a. Define Non Deterministic Pushdown Automata. Construct an NPDA for the Language $L = \{W \in (a, b)^* : n_a(w) = n_b(w)\}$ and draw the transition diagram. **(10 Marks)**

b. Define Handle and Handle Pruning. For the following grammar perform shift reduce for the string $id_1 + id_2 * id_3$.
$E \rightarrow E + E$
$E \rightarrow E * E$
$E \rightarrow (E)$
$E \rightarrow id.$ **(10 Marks)**

OR

8 a. Define Instantaneous Description in Pushow down Automata. Construct an NPDA for the Language $L = \{ WCW^R : W \in (a, b)^*\}$. **(10 Marks)**

b. Consider the Grammar.
$S \rightarrow L = R \mid R$
$L \rightarrow * R \mid id$
$R \rightarrow L$
Verify the grammar is SLR (1) or not through the suitable parsing table. **(10 Marks)**

Module-5

9 a. Define Turing Machine. Construct a Turing Machine to recognize the Language.
$L = \{a^n b^n : W \in \{a, b\}^* \ n \geq 1\}$. **(10 Marks)**

b. Write the SDD for the grammar. Also construct the Annotated Parse tree for 5 * 6 + 7 ;
$S \rightarrow EN$
$E \rightarrow E + T$
$E \rightarrow E - T$
$E \rightarrow T$
$T \rightarrow T * F$
$T \rightarrow T / F$
$T \rightarrow F$
$F \rightarrow (E)$
$F \rightarrow digit$
$N \rightarrow ;$ **(10 Marks)**

OR

10 a. Construct a Turing Machine to recognize the Language.
$L = \{0^n 1^n 2^n \mid n \geq 1\}$ and trace the string 0 0 1 1 2 2. **(12 Marks)**

b. For the Grammar construct the SDD and the annotated parse tree for the string 3 * 5 * 4 and show the Evaluation order.

$T \rightarrow FT'$
$T' \rightarrow * FT'$
$T' \rightarrow \in$
$F \rightarrow$ digit. **(08 Marks)**

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21CS52

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Computer Networks

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Discuss OSI Reference model with a neat diagram. **(10 Marks)**

b. Explain Unicast, Multicast and broadcast in computer networks. **(10 Marks)**

OR

2 a. Discuss the following transmission medium with diagram,
(i) Co-axial cable.
(ii) Fibre optic cable. **(10 Marks)**

b. Explain the design issues in computer networks. **(10 Marks)**

Module-2

3 a. Explain error detecting codes and obtain the CRC code for the frame given polynomial 1101011111 using the generator $G(x) = x^4 + x + 1$. **(10 Marks)**

b. Explain framing with Byte Count and Flag bits with bit stuffing. **(10 Marks)**

OR

4 a. Illustrate the Hamming code method with an example. **(10 Marks)**

b. Explain the following with examples:
(i) Binary convolution code.
(ii) Reed Solomen code. **(10 Marks)**

Module-3

5 a. Discuss Store and Forward packet switching. **(10 Marks)**

b. Explain the services provided by Network layer to Transport layer. **(10 Marks)**

OR

6 a. Discuss shortest path algorithm. **(10 Marks)**

b. Explain the approaches to congestion control in Network layer. **(10 Marks)**

Module-4

7 a. Explain Berkeley Sockets in detail. **(10 Marks)**

b. Explain socket programming with an example. **(10 Marks)**

OR

8 a. Explain TCP protocol with TCP segment header. **(10 Marks)**

b. Explain TCP connection establishment and TCP connection release with code snippet. **(10 Marks)**

Module-5

9 a. Explain the process communication in the Application layer. **(10 Marks)**

b. Discuss the Transport services provided by the Internet. **(10 Marks)**

OR

10 a. Explain the web and HTTP with Request response behaviour. **(10 Marks)**

b. Discuss the Electronic Mail in the Internet. **(10 Marks)**

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Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Database Management Systems

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Discuss the advantages of database management approach over file processing system. **(04 Marks)**

b. Describe the characteristics of database approach. **(08 Marks)**

c. Explain three schema architecture and reason for need of mapping among schema level. **(08 Marks)**

OR

2 a. With a neat diagram, explain the component modules of DBMS and their interactions. **(08 Marks)**

b. Define the following terms with examples :
i) Super key
ii) Candidate key
iii) Primary key. **(06 Marks)**

c. Construct an ER diagram for a car insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents. **(06 Marks)**

Module-2

3 a. Describe the three main categories of constraints on database. Explain with example. **(10 Marks)**

b. Given the schema :
Passenger (<u>pid</u>, pname, pgender, pcity)
Agency (<u>aid</u>, aname, acity)
Flight (<u>fid</u>, fdate, time, src, dest)
Booking (<u>pid</u>, <u>aid</u>, <u>fid</u>, fdate)
Give relation algebra expression for the following :
i) Retrieve the complete details of all flights to New Delhi
ii) Find only flight numbers for passenger with pid 123 for flights to Chennai before 06/11/2020
iii) Find the passengers names for those who do not have any bookings in any flights
iv) Get the details of flights that are scheduled on both dates 01/12/2023 and 02/12/2023 at 16 : 00 hours
v) Find the details of all male passengers who are associated with jet agency. **(10 Marks)**

OR

4 a. Give the ER to relateional mapping algorithm. Discuss each step with an example. **(10 Marks)**

b. Describe the characteristics of relations with examples. **(10 Marks)**

Module-3

5 a. Determine the six clauses in the syntax of an SQL retrieval query. **(06 Marks)**

b. What is a view? Explain how views are created and dropped with example. **(06 Marks)**

c. Consider the following schemes :
SAILOR (SID, SNAME, RATING, AGE)
BOAT (BID, BNAME, COLOR)
RESERVE (SID, BID,DAY)
Specify the following queries in SQL :
i) Retrieve the sailor names that have reserved red and green boats
ii) Retrieve the colors of boats reserved by RAJ
iii) Retrieve the SID's of sailors with age over 20, who have not reserved a red boat
iv) Retrieve the names of sailors who have reserved all boats. **(08 Marks)**

OR

6 a. Define stored procedures. Explain the creating and calling of stored procedure with suitable example. **(10 Marks)**

b. What is a CURSOR? Explain with an example, retrieving multiple tuples with embedded SQL. **(10 Marks)**

Module-4

7 a. Explain the informal design guidelines used as measure to determine the quality of relation schema design. **(08 Marks)**

b. Explain 1NF, 2NF and 3NF with an example for each. **(12 Marks)**

OR

8 a. Define multivalued dependency. Explain 4NF with an example. **(10 Marks)**

b. What is functional dependency? Write an algorithm to find the minimal cover for set of functional dependency. Find canonical cover of F the FD.
$F = \{A \rightarrow B\,C,\ B \rightarrow C,\ A \rightarrow B,\ AB \rightarrow C\}$. **(10 Marks)**

Module-5

9 a. Why concurrency control and recovery are needed in DBMS? Explain types of problems that may occur when two simple transactions run concurrently. **(10 Marks)**

b. Discuss the ACID properties of database transaction. **(05 Marks)**

c. Explain transaction support in SQL. **(05 Marks)**

OR

10 a. Briefly discuss the two phases locking technique for concurrency control. **(10 Marks)**

b. With a neat diagram, explain the typical states that a transaction goes through during execution. **(10 Marks)**

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BCS501

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Software Engineering and Project Management

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain software process and software engineering practices.	10	L2	CO1
	b.	Explain the waterfall model and incremental model, with diagram.	10	L2	CO1
		OR			
Q.2	a.	Explain Boehm Spiral process model with a neat diagram. Mention its advantages and disadvantages.	10	L2	CO1
	b.	Explain the five activities of a generic process framework for software engineering.	10	L2	CO1
		Module – 2			
Q.3	a.	Explain the distinct tasks of requirement engineering.	10	L2	CO2
	b.	Illustrate the UML use case diagram for safe home system.	10	L2	CO2
		OR			
Q.4	a.	Explain Class-Responsibility-Collaborator(CRC) modeling and data modeling with an example.	10	L2	CO2
	b.	Explain the elements of analysis model in requirement modeling.	10	L2	CO2
		Module – 3			
Q.5	a.	Explain the principles of agile process development.	10	L2	CO3
	b.	Explain the following : i) Adaptive software development ii) SCRUM	10	L2	CO3
		OR			
Q.6	a.	Explain the concepts of extremes programming with a neat diagram.	10	L2	CO3
	b.	Explain design modeling principles that guide the respective framework activity.	10	L2	CO3
		Module – 4			
Q.7	a.	Illustrate the project management life cycle with a neat diagram.	10	L2	CO4
	b.	Explain : i) Different ways of categorizing software projects ii) Smart objectives	10	L2	CO4
		OR			
Q.8	a.	Explain the difference between traditional versus modern project management practices along with the role of management.	10	L3	CO4
	b.	Explain software development life cycle (ISO 12207) with a neat diagram.	10	L2	CO4
		Module – 5			
Q.9	a.	Explain Quality Management System with principles of BS EN ISO-9001-2000.	10	L2	CO5
	b.	Explain the following : i) McCall model ii) Garvin's Quality Dimensions.	10	L2	CO5
		OR			
Q.10	a.	Describe six generic functions allowed in automated estimation techniques of software projects.	10	L3	CO5
	b.	Explain COCOMO II model.	10	L2	CO5

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BCS502

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Computer Networks

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	**a.**	What is data communication? List and explain characteristics and components of communication model.	**06**	**L1**	**CO1**
	b.	Define switching. Explain Circuit Switched Network and Packet Switched Network.	**06**	**L2**	**CO1**
	c.	With neat sketch, explain different layers of TCP/IP protocol suite.	**08**	**L2**	**CO1**
		OR			
Q.2	**a.**	What are guided transmission media? Explain twisted pair cable in detail.	**06**	**L1**	**CO1**
	b.	What is Virtual Circuit Network (VCN)? With neat diagram, explain three phases involved in VCN.	**08**	**L1**	**CO1**
	c.	Write a note on Encapsulation and decapsulation at Source Host for TCP/IP protocol suite.	**06**	**L2**	**CO1**
		Module – 2			
Q.3	**a.**	Define Redundancy. Explain CRC encoder and CRC decoder operation with block diagram.	**08**	**L2**	**CO2**
	b.	Distinguish between Flow Control and Error Control. Explain Stop and Wait Protocol.	**08**	**L2**	**CO2**
	c.	List and explain Control Fields of I-frames, S-frames and U-frames.	**04**	**L2**	**CO2**
		OR			
Q.4	**a.**	What is Hamming distance? With example, explain Parity Check Code.	**06**	**L1**	**CO2**
	b.	Define Framing. Explain character oriented framing and bit-oriented framing.	**06**	**L1**	**CO2**
	c.	With flow diagram, explain CSMA/CA.	**08**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Explain virtual-circuit approach to route the packets in packet-switched network.	**10**	**L2**	**CO3**
	b.	Illustrate the working of OSPF and BGP.	**10**	**L3**	**CO3**
		OR			
Q.6	**a.**	Explain IPv6 datagram format.	**10**	**L2**	**CO3**
	b.	Write an Dijikstra's algorithm to compute shortest path through graph.	**06**	**L1**	**CO3**
	c.	Write a note on Routing Information Protocol (RIP) algorithm.	**04**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Explain Go-Back-N protocol working.	**10**	**L2**	**CO4**
	b.	With neat sketch, explain three-way handshaking of TCP connection establishment.	**10**	**L2**	**CO4**

		OR			
Q.8	**a.**	With an outline, explain selective repeat protocol.	**10**	**L2**	**CO4**
	b.	List and explain various services provided by User Datagram Protocol (UDP).	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Briefly explain Secure Shell (SSH).	**10**	**L2**	**CO4**
	b.	Write a note on Request message and response message formats of HTTP.	**10**	**L2**	**CO4**
		OR			
Q.10	**a.**	With neat diagram, explain the basic model of FTP.	**04**	**L2**	**CO4**
	b.	Describe the architecture of electronic mail (e-mail).	**06**	**L3**	**CO4**
	c.	Briefly explain Recursive Resolution and Iterative Resolution in DNS.	**10**	**L2**	**CO4**

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BCS503

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

Theory of Computation

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

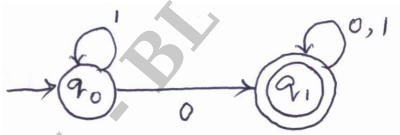
		Module – 1	M	L	C
Q.1	**a.**	Define the following with example : i) Language ii) String iii) Power of an alphabet.	**3**	**L1**	**CO1**
	b.	Define DFA. Draw a DFA to accepts. i) The set of all strings that contain a substring aba. ii) To accept the stings of a's and b's that contain not more than there b's. iii) $L = \{w \in \{a, b\}^* :$ No 2 consecutive characters are same in w$\}$.	**10**	**L3**	**CO1**
	c.	Convert the following NFA to DFA.	**7**	**L2**	**CO1**

		0	1
→	p	{p, q}	{p}
	q	{r}	{r}
	r	{s}	ϕ
*	s	{s}	{s}

OR

			M	L	C
Q.2	**a.**	Define the following with example : i) Alphabet ii) Reversal of string iii) Concatenation of Languages.	**3**	**L1**	**CO1**
	b.	Design a DFA for the Language : $L = \{w \in \{0, 1\}^* :$ w is a string divisible by 5$\}$.	**7**	**L3**	**CO1**
	c.	Define NFA. Obtain an ε - NFA which accepts strings consisting of 0 or more a's , followed by 0 or more b's followed by 0 or more C's. Also convert it to DFA.	**10**	**L2**	**CO1**

		Module – 2	M	L	C
Q.3	**a.**	Define Regular expression. Write the regular expression for the following languages : i) Strings of a's and b's starting with a and ending with b. ii) Set of strings that consists of alternating 0's and 1's. iii) $L = \{a^n bm , (n + m)$ is even$\}$. iv) $L = \{w : / w / \bmod 3 = 0 ,$ where $w \in \{a, b\}^*\}$.	**10**	**L2**	**CO2**

<table>
<tr><td></td><td>b.</td><td>Minimize the following finite automata using Table filling algorithm :
<table>
<tr><th></th><th>δ</th><th>a</th><th>b</th></tr>
<tr><td>→</td><td>A</td><td>B</td><td>A</td></tr>
<tr><td></td><td>B</td><td>A</td><td>C</td></tr>
<tr><td></td><td>C</td><td>D</td><td>B</td></tr>
<tr><td>*</td><td>D</td><td>D</td><td>A</td></tr>
<tr><td></td><td>E</td><td>D</td><td>F</td></tr>
<tr><td></td><td>F</td><td>G</td><td>E</td></tr>
<tr><td></td><td>G</td><td>F</td><td>G</td></tr>
<tr><td></td><td>H</td><td>G</td><td>D</td></tr>
</table></td><td>10</td><td>L2</td><td>CO2</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.4</td><td>a.</td><td>Construct ε - NFA for the following Regular expression :
i) $(0 + 1)\ 0\ 1(1 + 0)$ ii) $1(0 + 1)^*\ 0$ iii) $(0 + 1)^*\ 0\ 1\ 1^*$</td><td>6</td><td>L1</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Obtain the Regular expression that denotes the language accepted by Fig. Q4(b).
Fig. Q4(b)
 

Using Kleene's theorem.</td><td>6</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>State the Pumping Lemma for the Regular Languages. And also prove that the following languages are note regular.
i) $L = \{0^n\ 1^m \mid n \le m\}$ ii) $L = \{0^n\ 1^m\ 2^n \mid n, m \ge 1\}$.</td><td>8</td><td>L1</td><td>CO2</td></tr>
<tr><td colspan="6">Module – 3</td></tr>
<tr><td>Q.5</td><td>a.</td><td>Design CFG for the following languages :
i) $L = \{a^n\ b^{n+3}, n \ge 0\}$
ii) $L = \{a^i\ b^j\ c^k,\ j = i + k,\ i \ge 0,\ k \ge 0\}$
iii) $L = \{w\ /\ /w/ \bmod 3 > 0$ where $w \in \{a\}^*\}$
iv) $L = \{a^m\ b^n\ /\ m \ne n\}$
v) Palinderomes over 0 and 1.</td><td>10</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>Consider the grammar G with productions.
$S \rightarrow A\ b\ B\ /\ A\ /\ B$; $A \rightarrow aA\ /\ \varepsilon$; $B \rightarrow a\ B\ /\ b\ B\ /\ \varepsilon$.
Obtain LMD , RMD and parse tree for the string aaabab.
Is the given grammar ambiguous?</td><td>10</td><td>L2</td><td>CO3</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.6</td><td>a.</td><td>Define the following with example :
i) Context free grammar ii) Left most Derivation
iii) Parse tree iv) Ambiguous grammar.</td><td>4</td><td>L1</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>Design PDA for the language :
$L = \{a^i\ b^j\ c^k\ /\ i + k = j\ ,\ i \ge 0\ ,\ k \ge 0\}$ and show the moves made by the PDA for the string aabbbc.</td><td>10</td><td>L3</td><td>CO3</td></tr>
</table>

	c.	Convert the following CFG's to PDA : $S \rightarrow a\,A$; $A \rightarrow a\,ABC / bB / a$; $B \rightarrow b$; $C \rightarrow c$.	**6**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Define CNF. Convert the following CFG to CNF $E \rightarrow E + T / T$ $T \rightarrow T * F / F$ $F \rightarrow (E) / I$ $I \rightarrow Ia / Ib / a / b$.	**10**	**L2**	**CO4**
	b.	Show that $L = \{0^n\,1^n\,2n / n \geq 1\}$ is no context free.	**4**	**L2**	**CO4**
	c.	Prove that the family of context free languages is closed under union and concatenation.	**6**	**L1**	**CO4**
		OR			
Q.8	**a.**	Define Greibach Normal Form. Convert the following CFG to GNF. $S \rightarrow AB$; $A \rightarrow aA / bB / b$; $B \rightarrow b$.	**6**	**L2**	**CO4**
	b.	Consider the following CFG : $S \rightarrow ABC / BaB$ $A \rightarrow aA / BaC / aaa$ $B \rightarrow bBb / a / D$ $C \rightarrow CA / AC$ $D \rightarrow \varepsilon$ i) What are useless symbols? ii) Eliminate ε - productions , Unit productions and useless symbols from the grammar.	**10**	**L3**	**CO4**
	c.	Prove that the following languages are not context free. i) $L = \{ai / i \text{ is prime}\}$ ii) $L = \{a^{n^2} / n \geq 1\}$.	**4**	**L2**	**CO3**
		Module – 5			
Q.9	**a.**	Define a turing machine and explain with neat diagram, the working of a basic turing machine.	**6**	**L1**	**CO4**
	b.	Design a Turing machine to accept the language, $L = \{a^n\,b^n\,c^n / n \geq 1\}$. Draw the transition diagram and show the moves for the string aabbcc.	**14**	**L4**	**CO4**
		OR			
Q.10	**a.**	Design a Turing machine to accept palindrome over {a, b} and draw the transition diagram.	**12**	**L4**	**CO5**
	b.	Write a short notes on : i) Recursively Enumerable Language. ii) Multitape Turing Machine.	**8**	**L1**	**CO5**

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CBCS SCHEME

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BCS515B

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Artificial Intelligence

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***M : Marks , L: Bloom's level , C: Course outcomes.***

		Module – 1	M	L	C
Q.1	a.	Define the following : i) Intelligence ii) Artificial Intelligence iii) Agent iv) Rationality v) Logical reasoning.	5	L2	CO1
	b.	Examine the AI literature to discover whether the following tasks can currently be solved by computers. i) Playing a decent game of table tennis (ping-pong) ii) Discovering and proving new mathematical theorems iii) Giving competent legal advice in a specialized area of law iv) Performing a complex a surgical operation.	8	L2	CO1
	c.	Implement a simple reflex agent for the vacuum environment. Run the environment with this agent for all possible initial dirt configurations and agent locations. Record the performance score for each configuration and the overall score.	7	L3	CO1
		OR			
Q.2	a.	Is AI a science, or is it engineering or neither or both? Explain.	5	L2	CO1
	b.	Write pseudocode agent programs for the goal based and utility based agents.	8	L1	CO1
	c.	For each the following activities give a PEAS description. i) Playing a tennis match ii) Performing a high jump iii) Bidding on an item in an auction.	7	L1	CO1
		Module – 2			
Q.3	a.	Explain why problem formulation must follow goal transformation.	5	L1	CO1
	b.	Give complete problem formulation for each of the following choose a formulation that is precise enough to be implemented. i) Using only four colors, you have to color a planar graph in such a way that no two adjacent regions have the same color. ii) A 3 – foot – tall monkey is in a room where some bananas are suspended from the 8-foot ceiling. He would like to get the bananas. The room contains two stackable, moveable, climbable 3-foot high crates.	8	L2	CO2
	c.	Prove each of the following statements or given counter example : i) Breadth – first search is a special case of uniform – cost search. ii) Uniform – cost search is a special case of A^* search.	7	L2	CO2

		OR			
Q.4	**a.**	Define the following terms with example. i) State space ii) Search node iii) Transition model iv) Branching factor.	**8**	**L2**	**CO2**
	b.	Show that the 8-puzzle states are divided in to two disjoint sets, such that any state is reachable from any other state in the same set, while no state is reachable from any state in the other set. Devise a procedure to decide which set a given state is in and explain why this is useful for generating random state.	**7**	**L2**	**CO2**
	c.	Describe a state space in which iterative deepening search performs much worse than depth first search for example, $O(n^2)$Vs $O(n)$).	**5**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Devise a state space in which A^* using GRAPH-SEARCH returns a suboptimal solution with h(n) function that is admissible but inconsistent.	**7**	**L2**	**CO3**
	b.	Which of the following are correct? i) $(A \vee B) \wedge (\neg C \vee \neg D \vee E) F (A \vee B)$ ii) $(A \vee B) \wedge (\neg C \vee \neg D \vee E) F (A \vee B) \wedge (\neg D \vee E)$ iii) $(A \vee B) \wedge \neg(A \Rightarrow B)$ is satistiable iv) $(A \Leftrightarrow B) \Leftrightarrow C$ has the same number of models as $(A \Leftrightarrow B)$	**8**	**L1**	**CO3**
	c.	Consider a vocabulary with only four propositions, A, B, C and D. How many models are there for the following sentences? i) $B \vee C$ ii) $\neg A \vee \neg B \vee \neg C \vee \neg D$ iii) $(A \Rightarrow B) \wedge A \wedge \neg B \wedge C \wedge D$.	**5**	**L1**	**CO3**
		OR			
Q.6	**a.**	Prove that if a heuristic is consistent, it must be admissible. Construct an admissible heuristic that is not consistent.	**8**	**L1**	**CO3**
	b.	Prove each of the following assertions : i) $\alpha \equiv \beta$ if and only if the sentence $(\alpha \Leftrightarrow \beta)$ is valid ii) $\alpha \neq \beta$ if and only if the sentence $\alpha \wedge \neg\beta)$ is unsatisfiable.	**7**	**L1**	**CO3**
	c.	Prove, or find a counter example to each of the following assertions. i) If $\alpha \neq (\beta \wedge \gamma)$ then $\alpha \neq \beta$ and $\alpha \neq \gamma$ ii) If $\alpha \neq (\beta \vee \gamma)$ then $\alpha \neq \beta$ and $\alpha \neq \gamma$ (or) both	**5**	**L1**	**CO3**
		Module – 4			
Q.7	**a.**	Which of the following are valid necessary true sentences? i) $(\exists x\, x = x) \Rightarrow (\forall y \exists z\, y = z)$ ii) $\forall x\, P(x) \vee \neg p(x)$ iii) $\forall x$ smart(x) $\vee (x = x)$	**7**	**L1**	**CO4**
	b.	Prove that universal Instantiation is sound that existential instanticition produces an inferentially equivalent knowledge base.	**5**	**L1**	**CO4**

	c.	Write down logical representations for the following sentences, suitable for use with generalized modulus ponens : i) Horses, cows and pigs are mammals ii) Bluebeard is Charlie's parent iii) Offspring and parent are inverse relations	8	L1	CO4
		OR			
Q.8	a.	Consider a knowledge base containing just two sentence ; P(a) and P(b) does this knowledge base entail $\forall x\, P(x)$? Explain your answer interms of models.	5	L2	CO4
	b.	Suppose a knowledge base contains just one sentence, $\exists x AsHighAs(x, Everest)$ which of the following are legitimate results of applying existential instantiation? i) AsHighAs(Kilimanjaro, Everest) ii) AsHighAs(Kilimanjaro, Everest) $\wedge$ AsHighAs (Benvevis, Everest)	8	L2	CO4
	c.	Explain how to write any 3-SAT problem of arbitrary size using a single first order definite clause and no more than 30 ground facts.	7	L2	CO4
		Module – 5			
Q.9	a.	i) Give a backward chaining proof of the sentence $7 \le 3 + 9$. Show only the steps that leads to success ii) Give a forward chaining proof of the sentence $7 \le 3 + 9$. Show only the steps that leads to success.	8	L1	CO5
	b.	Describe the differences and similarities between problem solving and planning.	5	L2	CO5
	c.	Prove that backward search with PDDL problems is complete.	7	L1	CO5
		OR			
Q.10	a.	The following prolog code defines a predicate P P(x, [x|y]), P(x, [y|z]) :- P(x, z) i) Show proof trees and solutions for the queries P(A, [2, 1, 3]) and P(z,[1, A, 3]) ii) What standard list operation does P represent?	8	L1	CO5
	b.	Explain why dropping negative effects from every action schema in a planning problem results in a relaxed problems.	5	L2	CO5
	c.	Prove the following assertions about planning graphs : i) A literal that does not appear in the final level of the graph connot be achieved. ii) The level cost of a literal in a serial graph is no greater than the actual cost of an optimal plan for achieving it.	7	L1	CO5

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