

Heaven's Light Is Our Guide
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
4th Year Even Semester Examination 2022
COURSE NO: CSE 4221 COURSE TITLE: Data Mining
FULL MARKS: 72 TIME: 3 HRS

N.B. (i) Answer any SIX questions taking any THREE from each section.

(ii) Figures in the right margin indicate full marks.

(iii) Use separate answer script for each section.

		<u>SECTION : A</u>	Marks	CO
Q.1.	(a)	The goal of data mining is to uncover hidden patterns and trends that can be valuable for making informed decisions, predictions and identify areas for improvement. Now describe how the confluence of multiple disciplines influences the evaluation of data mining.	4	C01
	(b)	Briefly outline how to compute the dissimilarity between objects described by the following: i) Nominal attributes ii) Numeric attributes.	4	C01
	(c)	Describe the measures used in filter model for feature selection.	4	C01
Q.2.	(a)	"Noise filter can use the voting scheme to determine what cases have to be removed from the training set." - Describe the difference between any two noise filters of this kind.	4	C02
	(b)	What do you mean by dimension reduction? Consider the dataset with two-dimensional patterns: (1, 2), (2, 4), (3, 6), (4, 8), (5, 10), (6, 12). The covariance matrix is provided as $\begin{bmatrix} 5.6 & 11.2 \\ 11.2 & 22.4 \end{bmatrix}$. Calculate 1 st principle component using PCA algorithm.	8	C01
Q.3.	(a)	"The identification of the attribute for the root node in each level in a decision tree is known as attribute selection?" - Describe the two popular attribute selection measures.	4	C03
	(b)	How can you measure information gain for decision tree attribute selection? Which one is better in terms of information gain in the following decision trees-	6	C03
Q.4.	(c)	Describe the over fitting scenario in case of decision tree.	2	C03
	(a)	Consider two-dimensional data points: $x_1(1, 2), x_2(3, 4), x_3(2.5, 4), x_4(1.5, 2.5), x_5(3, 5), x_6(2.8, 4.5), x_7(2.5, 4.5), x_8(1.2, 2.5), x_9(1, 3), x_{10}(1, 5), x_{11}(1, 2.5), x_{12}(5, 6), x_{13}(4, 3)$. Use the Euclidean distance with Eps=1 and Minpts=4. Find all core points, border points and noise points and show the final clusters using DBSCAN algorithm.	8	C03
	(b)	Write down the advantages and disadvantages of k-means clustering algorithm.	4	C03

SECTION: B

Q.5.	(a)	Consider the following table. Determine whether live-science-fiction and play-chess are correlated or not using chi-square calculation. Consider the significance level is 100.	3	C02									
		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td><td style="text-align: center;">Play chess</td><td style="text-align: center;">Don't play chess</td></tr> <tr> <td style="text-align: center;">Live-science-fiction</td><td style="text-align: center;">250(90)</td><td style="text-align: center;">200(360)</td></tr> <tr> <td style="text-align: center;">Don't-like-science-fiction</td><td style="text-align: center;">50(120)</td><td style="text-align: center;">1000(840)</td></tr> </table>		Play chess	Don't play chess	Live-science-fiction	250(90)	200(360)	Don't-like-science-fiction	50(120)	1000(840)		
	Play chess	Don't play chess											
Live-science-fiction	250(90)	200(360)											
Don't-like-science-fiction	50(120)	1000(840)											
	(b)	Define normalization. What is the purpose of normalization? Explain Min-max normalization, z-score normalization and normalization by decimal scaling with example.	5	C02									
	(c)	Imagine you are working on a data mining project and you have a dataset containing information about house prices in a city. You want to build a regression model to predict house prices based on	4	C02									

- various features such as number of rooms, square footage and proximity to amenities. How could you approach the task of feature selection to build an effective regression model for predicting house prices?
- Q.6.**
- (a) How does SVM handle multi-class classification problem? In the scenario of multiclass classification problem, how does SVM predict the output for a new input? 4 CO3
 - (b) Consider the following confusions matrix. Calculate accuracy, precision, recall and F1 score from it. 6 CO3
- | | | |
|---|----|----|
| | 0 | 1 |
| 0 | 30 | 12 |
| 1 | 8 | 56 |
- Q.7.**
- (c) Differentiate between classification and regression. 2 CO3
 - (a) Explain Bootstrap Aggregating with proper figure. 4 CO3
 - (b) "Ensemble learning is the method that combines multiple learning algorithms to obtain performance improvements over its components"- Explain the statement with two ensemble learning process. 5 CO3
- Q.8.**
- (c) Formulate Naive Bayes classifier. 3 CO3
 - (a) Explain pre-pruning and post-pruning with examples. 4 CO3
 - (b) Differentiate between the following topics:
 (i) Regressing versus logistic regression.
 (ii) Sigmoid versus linear function. 4 CO3
 - (c) Write short note on-
 i) Objective/cost function
 ii) Gradient descent algorithm. 4 CO3

N.B. (i) Answer any SIX questions taking any THREE from each section.

- (ii) Figures in the right margin indicate full marks.
 - (iii) Use separate answer script for each section.
 - (iv) Course Outcomes (COs)

SECTION : A

Q.1.	(a)	Write the importance of using artificial intelligence in the real life world application.	03	CO1
	(b)	What are the differences between human brain and machine intelligence?	03	CO1
	(c)	Explain the learning process of biological neuron.	04	CO2
	(d)	Define basin of attraction with example.	02	CO1
Q.2.	(a)	Define feature vector and feature space with example.	03	CO1
	(b)	Write the difference between linear and non-linear classification algorithm.	03	CO1
	(c)	What is rogue pattern? How can you classify rogue pattern using nearest neighbor classification algorithm?	03	CO1
	(d)	Is it possible to classify more than two classes using linear classifier? If so, explain.	03	CO2
Q.3.	(a)	We have a reference vector X_{ref} (10,15) and another vector Y (12, 10). Find distance between these vectors using (i) Hamming distance measure (ii) Euclidian distance measure (iii) City block distance and (iv) Square distance.	04	CO1
	(b)	We have that $p(G_i X)$ means the probability of X belonging to class G_i for a Bayesian classifier. We can decide X belonging to class G_i for $p(G_i X) > p(G_j X)$ for $j = 1, 2, \dots, n$ and $i \neq j$ and Bayes law says,	08	CO1

$$p(G_i|X) = \frac{p(X|G_i) \times p(G_i)}{\sum_j p(X|G_j) \times p(G_j)}$$

$P(X|G_i)$ can be estimated by the following equation.

$P(X|G_i) = e^{-(X-\mu_i)^2}$. Here μ_i is the mean value of class G_i . Consider the following dataset.

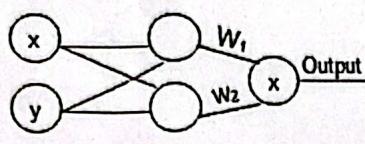
Height	Class
4.5	G ₁
5	G ₁
5.5	G ₁
6	G ₁
6.5	G ₂
7	G ₂
7.5	G ₂
8	G ₂

Find the class of height = 4.5 and the class of height = 6.25.

Q.4. (a) How many nodes are required for the output layer in multi-layer perceptron neural networks? And why? 02 CO2
(b) Write the steps of Back-Propagation neural networks algorithm with proper documentations. 06 CO2
(c) Write the importance of the hidden layer of Back-Propagation learning neural networks algorithm. 02 CO2
(d) Write the generalization property of Back- Propagation learning network algorithm. 02 CO2

SECTION : B

- Q.5.** Consider the following feed forward multilayer perceptron network using radial basis function and the XOR problem. 12 CO1



x	y	x XOR y
0	0	0
1	0	1
0	1	1
1	1	0

Let, two center of the given four pattern are $Y_1 (0, 0)$ and $Y_2 (1, 1)$. Here learning rate = 0.5, radial basis function is, $f(r) = e^{-r^2}$, where $r = \|X-Y\|$, X is the input pattern.

(i) Find the output of the hidden layer for each pattern defined in XOR problem.

(ii) Find the weight, w_1 and w_2 using perceptron learning algorithm.

- Q.6.** (a) Calculate the weights of the following patterns by using Hopfield neural network algorithm. 04 CO2

pattern 1 = { 1,1,1,1,1 }

pattern 2 = { 1,-1,-1,-1,1 }

pattern 3 = { 1,1,1,-1,1 }

pattern 4 = { -1,-1,-1,-1,1 }

- (b) How do you perform vector quantization using kohonen self-organizing neural network algorithm? 03 CO3

- (c) What is k-fold cross validation? What is the working principle of k-fold cross validation technique? 03 CO2

- (d) What are the importances of using confusion matrix to evaluate the performance of machine learning algorithm? How can you use it to predict the result of your developed machine learning model? 02 CO2

- Q.7.** (a) How can you implement Back-Propagation neural network algorithm in python? Write with necessary code. 03 CO2

- (b) What is fitness function? Write the importance of it. 03 CO2

- (c) Explain the working procedure of neuro-fuzzy system. 03 CO2

- (d) Write various types of crossover techniques of Genetic Algorithm. 03 CO2

- Q.8.** Consider the following optimization problem 12 CO3

$$\text{maximize } x_1^2 + x_2^2 + 5$$

$$\text{subject to } 0 \leq x_1, x_2 \leq 7.5$$

(i) Encode the variable x_1 and x_2 , where accuracy is 0.5

(ii) The initial population are given in the table below:

No	Population	
	x	y
1	0	0
2	1	0.5
3	0.5	2.5
4	1	4
5	3	5
6	7	4
7	7	6.5
8	3.5	6

Here each pair constructs a chromosome. Find the expected number of copies of the best string in the initial population of the mailing pool under Roulette wheel selection.

(iii) Select 3 pairs of survived chromosomes and perform two-point cross over. Finally find the fitness value of the created six children.

(iv) Select the lowest fitted chromosome after performing the crossover.

Now apply the mutation to the selected chromosome and find the fitness value.

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4th Year Even Semester Examination 2022

COURSE NO: CSE 4207

FULL MARKS: 72

COURSE TITLE: VLSI Design

TIME: 3 HOURS

- N.B.**
- (i) Answer any SIX questions taking any THREE from each section.
 - (ii) Figures in the right margin indicate full marks.
 - (iii) Use separate answer script for each section.
 - (iv) Course Outcomes (COs)

		SECTION : A	Marks	COs
Q.1.	(a) What is meant by physical design in VLSI? Explain the physical design process with flow diagram.	04	CO1	
	(b) Why is NMOS technology preferred more than PMOS technology?	02	CO1	
	(c) What are the objectives of floor planning and routing in VLSI design? Write the various ways of routing procedure.	04	CO1	
Q.2.	(d) Define body effect and write threshold equation including the body effect.	02	CO2	
	(a) What is a stick diagram? What are the uses of stick diagram?	03	CO3	
	(b) Implement the following function using CMOS technology and also draw the color plate stick diagram. $F = AB + C$	05	CO3	
	(c) Explain the basic four rules of color plate stick diagram of VLSI design with example.	04	CO3	
Q.3.	(a) Draw the typical I_{ds} versus V_{ds} characteristics curve of an enhancement mode NMOS for a constant V_{gs} , where the symbols represent usual meanings.	02	CO2	
	(b) How is surface state charge related to threshold voltage for a conducting NMOS transistor? Explain.	03	CO3	
	(c) Write short notes: Switch-box, Floating terminal, Cut-size.	03	CO4	
	(d) Consider an enhancement mode NMOS where $W:L = 1:1$. The gate input is 2V; source drain and body are connected to 1V, 2V and 0V respectively and threshold is 1V. Now determine the current through the NMOS.	04	CO3	
Q.4.	(a) What are transient and intermittent faults in integrated chips?	02	CO4	
	(b) Determine the behavioral and structural representation of a full-adder circuit.	03	CO4	
	(c) Given $V_{gs} = 0V, V_{td} = -3.8V, W_2/L_2 = 2:1$; now determine the value of R (R :Resistance) in $\text{M}\Omega$ to calculate the rising time for an NMOS inverter with depletion load and enhancement driver. Assume that all other parameters are in appropriate conditions.	03	CO3	
	(d) Suppose the effective output-wave form of a depletion load NMOS inverter with enhancement driver ranges from 0.8V to 4.2V due to some internal issues which was originally 0V to 5V. In this case, you are required to calculate the rising time of the given circuit. Determine the practical range that should be considered for the calculation of rising time.	04	CO3	
		SECTION : B		
Q.5.	(a) Analyze the different steps involved in P-well CMOS fabrication process with neat diagrams.	05	CO2	
	(b) Explain the basic processing steps involved in BiCMOS process.	04	CO2	
	(c) Draw the circuit diagram with the transmission gate which follows the given Boolean function. $F(A, B, C) = \bar{A}\bar{C} + BC$.	03	CO2	
Q.6.	(a) Explain different fault models in VLSI testing with examples.	04	CO4	
	(b) What are the approaches in design for testability? Explain.	04	CO4	
	(c) Design a 4-bit adder using MOS technology.	04	CO4	
Q.7.	(a) Draw the Gajski-Kuhn Y-Chart and its alternate representation with appropriate labeling.	03	CO4	
	(b) Explain VH, HV, VHV and HVH models of multilayer routing with appropriate diagrams.	04	CO4	
	(c) Consider a parity generator to detect errors in digital data. Now design a parity generator using MOSFET and address the pull-up and pull-down concept.	05	CO3	
	(d) Implement the following function using PLA logic. $F_1 = AB + B\bar{C}, \quad F_2 = ABC, \quad F_3 = A\bar{C}.$	03	CO3	
Q.8.	(a) What do you mean by Yield, Buried layer and Epitaxy layer?	03	CO2	
	(b) Why is DRAM so called? Draw the detailed internal structures of 1-bit DRAM and SRAM cell.	03	CO3	
	(c) Briefly introduce the sources of faults in VLSI circuits.	03	CO4	
	(d) Implement the following function using PLA logic. $F_1 = AB + B\bar{C}, \quad F_2 = ABC, \quad F_3 = A\bar{C}.$	03	CO3	

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	<u>SECTION : A</u>	Marks	CO
Q.1.	(a) Explain the steps of computer graphics pipeline with a suitable figure. 5 Also differentiate the computer graphics and image processing. (b) Find the coordinates of the pixel in the large image that is at the lower left corner of the small image if we want to cut a 512x512 sub-image out from the center of an 800x600 image. 3 (c) The direct coding method is flexible in that it allows the allocation of a different number of bits to each primary color. If 3 bits for red, 2 bits for blue and 6 bits for green are used per pixel, calculate the total number of colors, unique of course, can be generated. 4	5 3 4	CO1 CO1 CO1
Q.2.	(a) Write the pros and cons of DDA algorithm as well as the use of direct equation for drawing a line in 2D system. 4 (b) Explain Bresenham line drawing algorithm with proper mathematical analysis and identify the pixel positions along a line between A(10, 10) and B(18, 16) using it. 8	4 8	CO1 CO1
Q.3.	(a) How will you choose if a point is on a lines left or right side? Explain the working procedure of the weiler-Atherton algorithm with a proper example. 6 (b) Describe the transformation of coordinate systems from creating an object to display it on a screen. 6	6 6	CO3 CO2
Q.4.	(a) Derive the transformation that rotates an object point θ^0 about the origin. Write the matrix representation for this rotation. 4 (b) Reflect the diamond shaped polygon whose vertices are A(-1, 0), B(0, -2), C(1, 0) and D(0, 2) about: i) the horizontal line $y=2$, ii) the line $y=x+2$. 8	4 8	CO2 CO2

SECTION : B

- Q.5. (a) A unit square is transformed by a 2x2 transformation matrix. The resulting position vectors are: 4

$$\begin{bmatrix} 0 & 2 & 8 & 6 \\ 0 & 3 & 4 & 1 \end{bmatrix}$$

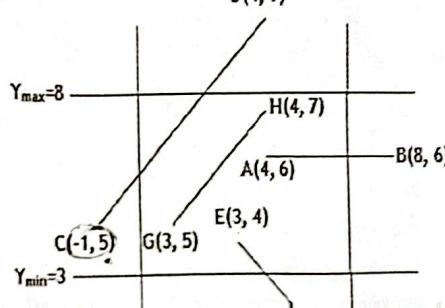
Find out the 2x2 transformation matrix.

- (b) Rotate the rectangle with vertices A(-3, -2), B(-3, 2), C(3, 2), D(3, -2) with respect to the line $y = 2x + 1$. 4
(c) A hexagon with vertices A(1, 1), B(2, 3), C(4, 4), D(5, 2), E(3, 0) and F(2, 1) undergoes a rotation of 120 degrees about the point (3, 2). Determine the new co-ordinates of the hexagon. 4

- Q.6. Consider the following figure-6 and answer the following questions: 12

- i) Describe the way to clip the line segments using Cohen-Sutherland algorithm and Liang-Barsky algorithm.
ii) Find the clipping categories and clip the line segments using the method of both Cohen-Sutherland and Liang-Barsky.

D(4, 9)



Q.7. (a) Consider the following figure 7(a), now answer the following 6 questions: CO3

- i) Clip the polygon using Sutherland Hodgman algorithm.
- ii) Clip the polygon using Weiler-Atherton algorithm.
- iii) Compare the output from the above questions (i) & (ii) if it has.

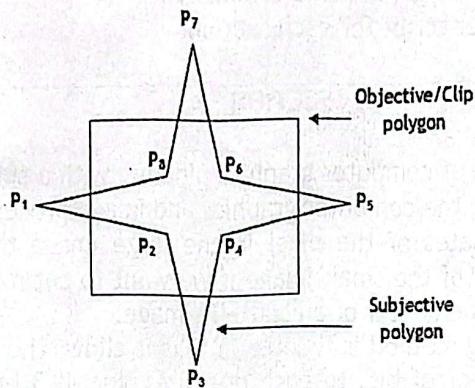


Figure - 7(a).

(b) The pyramid defined by the co-ordinates A(0, 0, 0), B(1, 0, 0), C(0, 1, 0) and D(0, 0, 1) is rotated 45° about the line L that has the direction $\vec{v} = \hat{j} + \hat{k}$ and passing through point C(0, 1, 0). Find the co-ordinates of the rotated figure. CO4

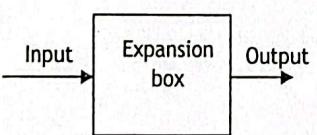
Q.8. (a) Why Raytracing isn't supported in older hardware? Provide your opinion. CO3
 (b) Solve to find out the color of the viewport coordinate $v(0, -0.5, 1)$ 8 CO4

- i) First sphere: centre= (0, 0, 2), radius= 1, color= (255, 0, 0) and
- ii) Second sphere: centre= (0, 0, 1), radius= 0.5, and color= (0, 0, 255).

The camera is at point O(0, 0, 0) and the background color will be seen through the given viewpoint coordinate if no intersection is found.

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4th Year Even Semester Examination 2022
COURSE NO: CSE 4215 COURSE TITLE: Network Security
FULL MARKS: 72 TIME: 3 HRS

- N.B. (i) Answer any SIX questions taking any THREE from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

		<u>SECTION : A</u>	Marks	CO	PO																																																																																					
Q.1.	(a)	Explain dictionary attacks and how these attacks can be minimized to protect our passwords. Use examples to explain it.	4	CO1	PO1																																																																																					
	(b)	Match the item of column-1 to the explanation of column-2 for the following table-	4	CO1	PO1																																																																																					
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Virus</td><td style="padding: 2px;">It refers to the denial or attempted denial by a node.</td></tr> <tr> <td style="padding: 2px;">Black hole Attack</td><td style="padding: 2px;">A scammer attempts to make a malicious website look exactly like a legitimate one.</td></tr> <tr> <td style="padding: 2px;">Spoofing</td><td style="padding: 2px;">Spread throughout a network without human existence.</td></tr> <tr> <td style="padding: 2px;">Worm</td><td style="padding: 2px;">Malicious software replicates itself when executed.</td></tr> <tr> <td style="padding: 2px;">Repudiation attack</td><td style="padding: 2px;">A malicious node falsely advertises good paths during path finding process.</td></tr> <tr> <td style="padding: 2px;">Brute-force attack</td><td style="padding: 2px;">Involves guessing username and password to gain unauthorized access to a system.</td></tr> </table>	Virus	It refers to the denial or attempted denial by a node.	Black hole Attack	A scammer attempts to make a malicious website look exactly like a legitimate one.	Spoofing	Spread throughout a network without human existence.	Worm	Malicious software replicates itself when executed.	Repudiation attack	A malicious node falsely advertises good paths during path finding process.	Brute-force attack	Involves guessing username and password to gain unauthorized access to a system.																																																																												
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	(c)	Prepare a risk assessment table for the following elements of a IT company: i) Cyber Attack ii) Power Supply iii) Client Confidential Documents iv) Network Bandwidth	4	CO1	PO1																																																																																					
Q.2.	(a)	Assume likelihood and consequence in the range 1-5. A S-box in DES algorithm plays a very important role to compress a bit stream. Using the following S[0] table if the partial inputs are i) 101011 ii) 000101 and iii) 011100	4	CO2	PO2																																																																																					
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	(b)	Design an expansion box that takes 2-bit hex and produces 4-bit hex. Find the output of the following expansion box if the input message is "82" in hex.	4	CO2	PO2																																																																																					
		 <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; text-align: center;"> <tr><td>8</td><td>3</td><td>4</td><td>1</td></tr> <tr><td>5</td><td>8</td><td>1</td><td>2</td></tr> <tr><td>3</td><td>4</td><td>7</td><td>3</td></tr> <tr><td>7</td><td>3</td><td>4</td><td>5</td></tr> </table> <p style="text-align: center;">Expansion Table</p>	8	3	4	1	5	8	1	2	3	4	7	3	7	3	4	5																																																																								
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7	3	4	5																																																																																							
Q.3.	(c)	Using Finite Field 2 ⁸ , evaluate the following expression in hex- $2AX01 + 3DX02$	4	CO2	PO2																																																																																					
	(a)	"ESP provides confidentiality, a feature AH does not provide"-explain briefly.	2	CO3	PO3																																																																																					
	(b)	Describe how ESP provides anti-replay service.	5	CO3	PO3																																																																																					
	(c)	Draw a block diagram that depicts different phases of SSL/TLS handshake protocol.	5	CO3	PO3																																																																																					
Q.4.	(a)	Describe the properties of Zigbee network.	4	CO4	PO2																																																																																					
	(b)	Draw a diagram that illustrates the working procedure of WEP.	5	CO4	PO2																																																																																					
	(c)	Describe some applications of wireless sensor network.	3	CO4	PO2																																																																																					
		<u>SECTION : B</u>																																																																																								
Q.5.	(a)	Guess the following IPsec packet and explain the elements in it:	4	CO3	PO3																																																																																					

	Outer IP Header	ESP Header	Original IP Header	TCP Header	Data	ESP Trailer	
	(b)	Describe how a web server is authenticated using a SSL certificate.					4 CO3 PO3
	(c)	If a security policy is implemented to protect a server from unwanted packets then draw a data flow diagram when the server receives some packets from unknown sites.					4 CO3 PO3
Q.6.	(a)	List the features of AAA protocol and how AAA can be implemented in a large network containing several routers.				3	CO3 PO3
	(b)	Draw the block diagram of PGP-based encryption providing email security and explain how both senders and receiver's authenticity can be verified.				3	CO3 PO3
	(c)	Explain why proxy server is used in computer network with the help of a diagram.				3	CO3 PO3
	(d)	How ACL is used to provide router level firewall? Explain it with an example.				3	CO3 PO3
Q.7.	(a)	RSA is an asymmetric encryption algorithm. Suppose the values of two prime numbers are p=5 and q=13. The value of e=11. i) Determine the public key and private key. ii) Determine the corresponding cipher text using the public key if the message is "7". iii) Determine the corresponding plaintext using the private key if the cipher text is "3".			4+4+4	CO2 PO2	
Q.8.	(a)	Discuss the role of firewall in the network and explain how it enhances the security of the network infrastructure.			4	CO3 PO3	
	(b)	Describe the different components of IEEE 802.11 (Wi-Fi) architecture.			5	CO4 PO2	
	(c)	Discuss the issues and challenges in wireless ad-hoc network.			3	CO4 PO2	
