

Answer **any three questions** from each section.

SECTION - A

- Q.1 (a) What is machine learning? When will we use machine learning? 1+1
 (b) Distinguish between over-fitting and under-fitting. 2
 (c) Discuss any four examples of machine learning applications. 2
 (d) A patient takes a lab test and the result comes back positive. It is known that the test returns a correct positive result in only 98% of the cases and a correct negative result in only 97% of the cases. Furthermore, only 0.008 of the entire population has this disease. 4
 i. What is the probability that this patient has cancer?
 ii. What is the probability that he does not have cancer?
 iii. What is the diagnosis?

- Q.2 (a) What is the difference between the supervised and unsupervised learning? 2
 (b) How do you perform Normalization and Standardization in feature scaling? 3
 (c) Decision tree splits the nodes on all available variables and then selects the split which results in most homogeneous sub-nodes. Referring to the example below where we want to classify the instances based on the target feature Y. In the example, we split the instances using three input features A, B, and C. Now, you need to identify which feature split produces more homogeneous sub-nodes using the Information Gain technique. 5

A	B	C	Y
1	1	1	1
1	1	0	1
0	0	1	0
1	0	0	0

- Q.3 (a) What is Zero frequency problem in Naïve Bayes Classifier? How to handle with Zero frequency problem? Explain with an example. 2+3
 (b) We have data from the questionnaires survey (to ask people opinion) and objective testing with two attributes (X1 - acid durability and X2 - strength) to classify whether a special paper tissue is good or not (Y). Here are four training samples. 5

X1	X2	Y
7	7	Bad
7	4	Bad
3	4	Good
1	4	Good

Now the factory produces a new paper tissue that pass laboratory test with X1 = 3 and X2 = 7. Without another expensive survey, can we guess what the classification of this new tissue is using kNN algorithm? Consider the value of k is 3.

- Q.4 (a) Consider the following confusion matrix for a binary classification model. Find accuracy and F1 score. Explain why accuracy is not enough for this classification. 2+2

		Actual Values	
		Positive (1)	Negative (0)
Predicted Values	Positive (1)	1	2
	Negative (0)	4	993

- (b) What are overfitting and underfitting in machine learning models? How to detect overfitting and underfitting? 2+
- (c) What is Cross validation (CV)? 2

SECTION-B

- Q.5 (a) What is an ensemble method? Distinguish between bagging and boosting? 1+2
- (b) How does Random Forests algorithm work? 3
- (c) Why does Support Vector Machine (SVM) select the hyperplane for which the margin is maximum? What are the kernel tricks in SVM? 2+2

- Q.6 (a) What is regression analysis? Why do you need to use regression analysis? 1+2
- (b) What is meant by regression line? How do you find a best-fit regression line? 1+3
- (c) Suppose you are given two list of values for a regression model (as follow): 3

Original values:	-2	1	-3	2	3	5	4	6	5	6	7
Predicted values:	-1	1	-2	2	3	4	4	5	5	7	7

Find MAE, MSE, and RMSE to evaluate the model.

- Q.7 (a) How is association rule mining used for Market Basket Analysis? 2
- (b) What are association rule evaluation metrics? Define each of them. 3
- (c) Suppose you have the following dataset that has various transactions, and from this dataset, you need to find the frequent itemsets and generate the association rules using the Apriori algorithm. Given: Minimum support count = 2 and minimum confidence = 0.8. 5

TID	Items
1	A, C, D
2	B, C, E
3	A, B, C, E
4	B, E

- Q.8 (a) What is the criteria for good clustering? 1
- (b) Answer the following questions for k-Means clustering algorithm. 4
- How do we choose the number of clusters k?
 - How do we choose the initial centroids?
 - How do we assign data points to centroids?
 - How do we update the centroids?
- (c) Consider the following proximity matrix. Find the clusters by applying single link and complete link hierarchical clustering. Also show your results by drawing a dendrogram. 5

Point	P1	P2	P3	P4	P5
P1	0	2.3	3.4	1.2	3.7
P2	2.3	0	2.0	1.8	2.2
P3	3.4	2.0	0	4.2	0.7
P4	1.2	1.8	4.2	0	4.4
P5	3.7	2.2	0.7	4.4	0

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Department of Computer Science & Engineering
B.Sc. Engineering Examination-2020

Course : CSE465 Robotics

Full Marks: 60 Time: 03 hours

N.B. Answer **SIX** questions, taking any **THREE** from each section.

Section A

- Q.1 (a) What is a Robot and Robotics? 2
(b) Draw a simple robotic system using the basic components. 4
(c) What do you mean by DOF? Write the names of the lower pair connectors of 1, 2 and 3 DOF. 4
- Q.2 (a) Why is the coordinate system used in a robotic system? Explain the cylindrical, spherical and revolute coordinate system with respect to joint pairs. 6
(b) What do you mean by the work envelope of a robotic system? 2
(c) What do you mean by forward and backward robot kinematics? 2
- Q.3 (a) Program DEMO. A 3
1. APPRO PART, 50
2. MOVES PART
3. CLOSEI
4. DEPARTS 150
5. APPROX BOX, 200
6. MOVE BOX
7. OPENI
8. DEPART 75
END
Explain the program
- (b) A robot that separates different type of garbage from mixed garbage, write your design considerations. 4
(c) What are the challenges of designing modern robots? 3
- Q.4 (a) Define actuators? Explain the working principles of different kinds of actuators. 5
(b) Draw a simple positional servo system 5

Section B

- Q.5 (a) Why is a stepper motor used in a robotic system? Describe the operating principle of a stepper motor. 6
(b) In a stepper motor what factors are responsible for measuring each step size? 2
(c) Draw a cross section of a stepper motor whose step size is 18 degrees. 2
- Q.6 (a) What is a sensor? Write five key characteristics of a sensor. 3
(b) How does artificial skin work? 3
(c) Describe the working mechanism of a proximity sensor. 4
- Q.7 (a) State the three laws that a robot must obey 3
(b) Explain the low and high level vision of a robot. 4
(c) How can you program for a modern robot? 3
- Q.8 (a) Write the role of a microcontroller to operate a robot. 3
(b) Could a robot be lefty or righty? 1
(c) Differentiate between contact and non-contact sensor. 3
(d) How does a tactile array sensor work? 3

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Department of Computer Science & Engineering Department

4th Year 2nd Semester B.Sc. Engineering Examination-2020

Course No: CSE457 **Cryptography and Network Security**

Full Marks: 60 Time: 3 hours

Answer Three questions from each section

Section A

- Q.1 (a) State the definitions of *Cryptography*, *Security* and *Steganography*. Classify security attacks with brief explanation. 6
- (b) Explain five ingredients of symmetric encryption scheme with appropriate figure. 4
- Q.2 (a) Describe the procedures of transposition cipher. Draw the CIA triad. 5
- (b) i) Construct a Playfair matrix with the key **happiness**. 5
- ii) Using this Playfair matrix of (i) encrypt and decrypt the following message:
Have a nice time.
- Q.3 (a) Differentiate between block and stream ciphers. 2
- (b) Draw the Feistel cipher structure. 3
- (c) Derive two keys for S-DES scheme for the following values: 5
- i) 10-bit key as input key: 1010110110
- ii) Two permutation function p10 and p8 as follows

P10									
1	5	8	9	4	10	3	7	2	6

P8							
6	5	7	4	8	3	10	9

- Q.4 (a) Sketch the overall structure of AES. 4
- (b) Apply the shift row transformations for the following state: 3
- | | | | |
|----|----|----|----|
| 63 | C9 | FE | 30 |
| A2 | B5 | 67 | D4 |
| EF | 3C | 5E | 32 |
| AB | CD | EF | 21 |
- (c) AES is more secured than DES. Justify it. Define Blowfish. 3

Section B

- Q.5 (a) List the key component of internet mail structure. What is the difference between S/MIME and OpenPGP? 3
- (b) What is traffic padding and what is its purpose? Show the differences exist between link and end-to-end encryption approaches using appropriate diagram. 5
- (c) Show the taxonomy of malicious program. 2
- Q.6 (a) What are the types of intruders? State the definition of IPS and IDS. 4
- (b) Classify and explain IDS. 4.5
- (c) What do you mean by password vulnerabilities? 1.5
- Q.7 (a) Why public-key cryptography is necessary? What are the requirements for message authentications are followed when communications across a network? 5
- (b) Perform encryption and decryption using RSA algorithm with $p=3$, $q=7$, $e=9$ and $n=5$. 5
- Q.8 (a) Apply Hill cipher where key is (hill) and plain text is HAPPY, find the cipher text. 3
- (b) Explain the pros and cons of steganography techniques in the field of multimedia security. 3
- (c) What is block cipher? Explain the working principle of block cipher algorithms. 4

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4th Year 2nd Semester B.Sc. Engineering Examination-2020

Course Title: Computer Peripherals and Interfacing

Course Code: CSE455

Full Marks: 60

Time: 3(Three) Hours

[Answer any **three** from each section; Digits of the right side indicate marks.]

Section A

- Q.1 (a) If peripherals could operate at similar speeds to CPU, peripheral adapter would no longer be needed for the operation. True or False? Justify your answer. 5
(b) What is an interrupt service routine? Explain the working principle of interrupt controller. 5
- Q.2 (a) The CPU can do other tasks and access the data bus during DMA operation. True or False? Justify your answer. 5
(b) Mention the control signals and their function of 8255A 5
- Q.3 (a) Explain priority interrupt using daisy chain diagram 5
(b) Briefly explain different types of I/O command. Draw the control word register format of PPI. 5
- Q.4 (a) State the difference between Polling and Interrupt driven I/O 5
(b) Write drawback of strobe signal. Explains source-initiated transfer using Handshaking. 5

Section B

- Q.5 (a) Briefly define the components of the Peripheral Adapter with a diagram. 5
(b) Describe DMA works with diagrams. 5
- Q.6 (a) State how Programmed I/O performs input and output operation. 5
(b) Why do we use 8259A? Explain the working principle of a CRT monitor 5
- Q.7 (a) Explain serial and parallel communications. Write down the differences between them. 4
(b) What are the types of transmission modes? Briefly explain them. 3
(c) What are AGP and Ps/2? 3
- Q.8 (a) Write down the purpose of I/O BUS and Interface Module 5
(b) Discuss the difference between synchronous and asynchronous data transmission technique. 5

Bangabandhu Sheikh Mujibur Rahman Science and Technology University

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4th Year 2nd Semester B.Sc. Engineering Examination-2020

Course: CSE452 Digital Image Processing
Answer **any three** from each section

Full Marks: **60** Time: 3 hours

Section A

- Q.1 (a) Give example of fields that uses Digital Image Processing (DIP). 2
(b) Explain fundamental steps in DIP. 8
- Q.2 (a) Define 8-neighbor. 1
(b) Explain a simple image formation model. 5
(c) What is pixel adjacency? Discuss different types of pixel adjacency. 4
- Q.3 (a) What is contrast stretching? 2
(b) Explain the LZW image compression technique. 5
(c) Discuss the gray level transformation with proper figure. 3
- Q.4 (a) What is image filtering? 2
An 8 level image is given bellow. Perform Histogram equalization and draw Histogram of original and equalized images. 4

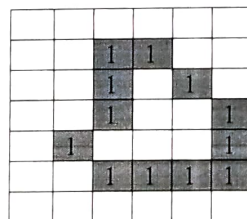
4	6	0	3	7
2	1	5	0	3
4	2	7	0	7
1	5	7	0	7
4	7	5	4	1

(b)

- (c) Discuss about image enhancement using spatial filtering with figure. 4

Section B

- Q.5 (a) What do you mean by compression of an image? Why do we require image compression? 2
Perform Huffman coding for the following set of symbols. 4
- | Symbol | Probability |
|--------|-------------|
| A | 0.2 |
| B | 0.1 |
| C | 0.05 |
| D | 0.6 |
| E | 0.05 |
- (b)
- (c) With the help of a block diagram, explain DCT based JPEG compression standard. 4
- Q.6 (a) What is Hit-or-Miss transformation? 2
What happened in Dilation and Erosion? Consider the following input image. Show the dilated image using the structuring element. 5



(b)

Input Image

Structuring Element

- (c) Explain about Boundary Extraction Algorithm, Region Filling Algorithm. 3
- Q.7 (a) What is image Segmentation? Why will we apply image segmentation? 2
(b) Differentiate between local, global and adaptive thresholding. 4
(c) Explain how Hough transform can be used to detect lines. 4
- Q.8 (a) What is edge detection? 1
What kind of operations are performed by using the following mask? 3
- | | | |
|----|----|----|
| -1 | -1 | -1 |
| 2 | 2 | 2 |
| -1 | -1 | -1 |
- Horizontal
- | | | |
|----|----|----|
| -1 | -1 | 2 |
| -1 | 2 | -1 |
| 2 | -1 | -1 |
- +45°
- | | | |
|----|---|----|
| -1 | 2 | -1 |
| -1 | 2 | -1 |
| -1 | 2 | -1 |
- Vertical
- | | | |
|----|----|----|
| 2 | -1 | -1 |
| -1 | 2 | -1 |
| -1 | -1 | 2 |
- 45°
- (c) Discuss the image segmentation applying morphological watershed model. 6