

Q. P. Code: 24459

(Time: 3 hours)

[Total Marks: 80]

N.B: 1) Question number 1 is compulsory

- 1) Attempt any three questions out of the remaining five questions
- 2) In all four questions to be attempted
- 3) Figures to the right indicate full marks

Q.1 (a) Justify or Contradict the following Statements

(10)

- (i) Histogram is a unique representation of an image.
- (ii) Quality of an image is decided by its tonal and spatial resolution
- (b) Explain in brief: Image Enhancement in frequency domain
- (c) Explain effects of (i) Opening (ii) Closing

(05)

(05)

Q.2 (a) Write applications/advantages of following

(10)

- (i) Compass operator (ii) Motion Vector (iii) Hough transform
- (iv) Bit plane slicing (v) High Boost filtering
- (b) Find K. L. transform of following image:  $\begin{bmatrix} 4 & -2 \\ -1 & 3 \end{bmatrix}$

(10)

Q.3 (a) Define edge in an image. Detect edge in the following image using strength (magnitude) and direction of gradient. Use Prewitt operator.

(10)

$$\text{Image} = \begin{bmatrix} 0 & 30 & 60 \\ 5 & 32 & 62 \\ 10 & 38 & 64 \end{bmatrix}$$

(b) Explain in detail optical flow equation for motion estimation in video signal.

(10)

Q.4 (a) Perform region filling operation to fill the image (A) using structuring element (B)

(06)

Image A =

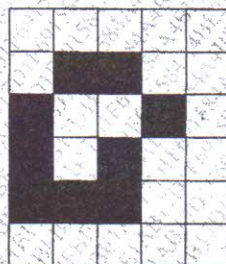
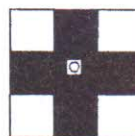


Image B =



- (b) State and prove translation property of DFT.
- (c) Explain in detail wiener filter. Derive formula for transfer function of wiener filter in frequency domain. What are the advantages of wiener filter over inverse filter?

(04)

(10)



Q. 5 (a) For the following image, Perform: (i) Low Pass Filtering (ii) High pass filtering (iii) Median filtering

Comment on your results.

(10)

0	2	1
1	100	2
2	0	1

(b) Write difference between: Image Enhancement and Image Restoration

(05)

(c) A 4x4 sub image is shown below. Let  $V = \{2, 4\}$ . Compute  $D_4$ ,  $D_8$  and  $D_m$  distance

(05)

between point p and q.

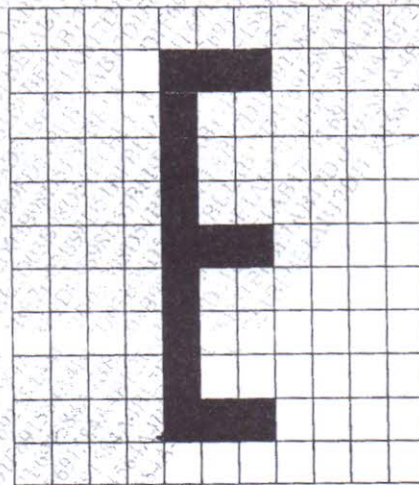
	0	1	2	3	y
0	4	2	2(p)	3	
1	4	3	2	1	
2	1	2	2	0	
3	2(q)	3	1	0	
x					

Q.6 (a) Explain pixel based method of motion detection technique in video.

(08)

(b) Segment the following image using split and merge technique. Draw quad tree representation for the segmented image

(06)

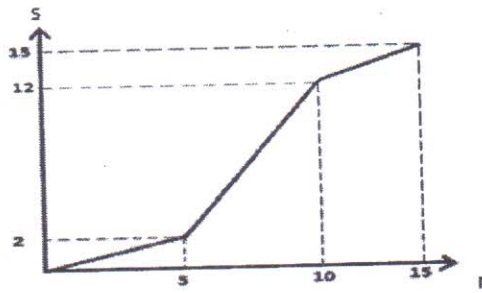


(c) For the digital image shown below in figure D, perform following operations

(06)

10	2	13	7
11	14	6	9
4	7	3	2
0	5	10	7

Figure (D)



Figure(C)

- 1) Contrast stretching as per the characteristics given in figure (C).
- 2) Draw the histogram of original and new image
- 3) Equalize the histogram



N.B.

i) Question no.1 is compulsory

ii) Solve any three from the remaining five questions

- 1 A How does OFDM provide high data rate? 5
- B Microcell zone concept helps in improving capacity of a cellular system . Justify. 5
- C What is software Defined Radio? 5
- D Differentiate between Rayleigh and Rician distribution. 5
- 2 A While designing a cellular system ,how are co-channel and adjacent channel interferences kept under control? What is the role of S/I ratio and Q in this? 10
- B Draw neatly and explain the role played by various entities in the GSM architecture. 10
- 3 A Describe the frequency and channel specifications of forward channels in CDMA1. 10
- B Explain the Handoff and power control in 3G systems . 10
- 4 A Give the main features of WCDMA and how are they different from CDMA 2000. 10
- B Elaborate on the contribution of MIMO techniques in LTE. 10
- 5 A Discuss the frames and slots in LTE. What is a Resource Block? 10
- B Classify small scale fading based on Multipath Time Delay Spread and Doppler Spread. 10
- 6 Write notes on:[any two] 20
- a)Indoor propagation Models      b)RAKE Receiver      c) Trunking & GOS
- d)GSM authentication & securit

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[Time: Three Hours]

[Marks:80]

Please check whether you have got the right question paper.

- N.B:
- 1) Question no. 1 is compulsory.
  - 2) Attempt any three questions from remaining questions.
  - 3) Figures to the right indicate full marks.

1. (a) Define Fresnel Reflection. Numerical Aperture and V-number. 5  
(b) Differentiate APD and PIN code. 5  
(c) Define Splicing. Mention its types and limitations. 5  
(d) Define Four Wave Mixing (FWM). 5
2. (a) Explain OTDR working principle in detail. Mention its limitation. 10  
(b) Discuss different types of Dispersion in optical fiber. 5  
(c) What is DWDM? Mention its advantages and disadvantages. 5
3. (a) Explain in brief any two Fiber Fabrication Techniques. 10  
(b) Explain working principle of LASER source used in optical fiber communication. 5  
(c) Compare Circulator and Isolators. 5
4. (a) Derive an expression for Link Power Budget Analysis of optical fiber. 7  
(b) Explain EDFA amplifier. Mention its advantages. 8  
(c) Explain Macro Bending loss. 5
5. (a) Explain Optical Safety and Cross talk. 10  
(b) Derive an expression for Power Penalty with Impairment. 10
6. Write short note on any two: 20  
(a) SONET / SDH  
(b) OTDM  
(c) Optical Access Network  
(d) Wavelength Stabilization

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(3 Hours)

Max Marks: 80

1. Question No. 1 is compulsory.
2. Out of remaining questions, attempt any three questions.
3. Assume suitable additional data if required.
4. Figures in brackets on the right hand side indicate full marks.

1. (A) Explain the working of Directional Couplers. (05)  
(B) Explain travelling wave tube as an amplifier. (05)  
(C) What is meant by RADAR range? (05)  
(D) Explain working of BARITT. (05)
2. (A) With a neat functional diagram explain the working principle of Cylindrical Magnetron. (10)  
(B) Radar operating at 1.5 GHz uses a peak pulse power of 2.5 MW and has a range of 100 nmi for objects whose radar cross section is  $1 \text{ m}^2$ . If the minimum receivable power of the receiver is  $2 \times 10^{-13}$  Watt, what is the smallest diameter of the antenna reflector could have assuming it to be a full paraboloid with  $\eta=0.65$ . (10)
3. (A) State various modes of Gunn diode and explain any one of them in detail. (10)  
(B) Explain Doppler Shift and its role in pulsed and CW RADAR. (10)
4. (A) Explain instrument landing system for aircraft navigation. (10)  
(B) Match a load impedance  $Z_L=60-j80$  to a  $50 \Omega$  line using a double stub tuner. The stubs are open circuited and are spaced  $\lambda/8$  apart. The match frequency is 2 GHz. (10)
5. (A) Discuss the various frequency bands and characteristics of microwaves. (10)  
(B) Write a short note on rectangular waveguide. (10)
6. (A) Give the working of Two Cavity Klystron. (10)  
(B) With block diagram explain the MTI radar system. Give its limitations. (10)

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Time: 3 hours

Marks: 80

- Q. 1 is compulsory. Solve any 3 questions from remaining 5.
- Assume required data where ever necessary with proper justification.

- Q.1** (a) What is the significance of modeling and coding in data compression? (20)  
 (b) What are the goals of cryptography? Explain any one in detail.  
 (c) List techniques used for lossless image compression.  
 (d) Solve the following  
 (i)  $4^{-1} \bmod 55$   
 (ii)  $3^{144} \bmod 13$   
 (iii)  $6^{-1} \bmod 17$   
 (iv) Euler's totient function  $\Phi(49)$
- Q.2** (a) What is 'frequency' and 'temporal' masking? Explain how it is used and implemented in MP3 audio compression. (10)  
 (b) Explain Diffie Hellman Key exchange with the help of an example. (10)
- Q.3** (a) Explain standard JPEG with neat block diagram. What are advantages of JPEG 2000 over standard JPEG? Justify the use of DCT in JPEG? (10)  
 (b) Explain RSA in detail and also discuss attacks on RSA. (10)
- Q.4** (a) State following theorems with their applications in cryptography (10)  
 (i) Fermat's Theorem (ii) Euler's Theorem (iii) Chinese Remainder Theorem.  
 (b) Explain Hash and MAC functions with their role in cryptography. (10)
- Q.5** (a) Consider the probabilities  $p(a)=0.2$ ,  $p(b)=0.3$ ,  $p(c)=0.1$ ,  $p(d)=0.4$ . Encode and decode the sequence 'abcad' using arithmetic coding technique. (10)  
 (b) What is Motion compensation and Motion Estimation in video compression? Explain how they are used in MPEG video compression with appropriate block diagram. (10)
- Q.6** (a) Encode and decode the sequence 'abbacbbabbacc' using LZ78. Compare LZ77 and LZ78. (10)  
 (b) Write short notes (Any two) (10)  
 (i)  $\mu$  Law and A Law Companding  
 (ii) Fire walls  
 (iii) Intruders and viruses

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(3 Hours)

Total Marks: 80

- N.B. : (1) Questions No.1 is **compulsory**.  
(2) Solve any **three** questions out of remaining **five** questions  
(3) Draw neat labelled diagram whenever necessary  
(4) Assume suitable data if necessary

- Q.1 Answer any 4 questions from the given questions: 5x4  
a. What is Hebbian learning rule? Describe it with mathematical concept.  
b. What is  $\lambda$ -cut sets? Brief with an example.  
c. Determine  $\lambda$ -cut sets for the given fuzzy sets

$$A = \left\{ \frac{0.1}{x_1} + \frac{0.2}{x_2} + \frac{0.7}{x_3} + \frac{0.5}{x_4} + \frac{0.7}{x_5} \right\}$$

$$B = \left\{ \frac{0.9}{x_1} + \frac{0.6}{x_2} + \frac{0.3}{x_3} + \frac{0.2}{x_4} + \frac{0.8}{x_5} \right\}$$

(a)  $(A \cup B)_{0.6}$  (b)  $(A \cup \bar{A})_{0.8}$  (c)  $\bar{B}_{0.3}$

- d. Is EX-OR function a linear or non-linear function? Justify your answer.  
e. Explain any four properties of fuzzy sets.

- Q.2 (a) What is meant by learning of neural network? Explain perceptron learning rule. (10)  
(b) How multi-layer perceptron can be used for face recognition. (10)

- Q.3 (a) What is the need for defuzzification. Explain any four techniques of defuzzification. (10)  
(b) Explain Error Back propagation algorithm with the help of flowchart. (10)

- Q.4 (a) Explain with the help of block diagram fuzzy inference system. (10)  
(b) Describe in detail discrete Hopfield network with properties of its weight matrix and convergence based on energy. (10)

- Q.5 (a) Explain the application of fuzzy logic for traffic control (10)  
(b) Explain pattern classification using Radial Basis Function Neural network. (10)  
Compare RBF and MLP.

- Q.6 (a) Classify the four vectors into two clusters using Kohonen Self organizing Map. (0011); (1000); (0110); (0001). Assume learning rate 0.5. Assume initial weights to be  $[0.2 \ 0.4 \ 0.6 \ 0.8; \ 0.9 \ 0.7 \ 0.5 \ 0.3]^T$ . (10)  
(b) Design fuzzy controller to determine wash time of a fuzzy washing machine. (10)  
Assume that the two inputs are dirt and grease on the cloths. The design should be supported by figures wherever possible. Clearly indicate that if the clothes are soiled to large degree the time required for washing is also more.

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