**Duration: 3 hours** **Max marks: 80**

**Note the following instructions.**

1) **Question No.1** is **compulsory.**
2) Total **four** questions need to be solved.
3) Attempt **any three** questions from remaining five questions.
4) Assume suitable data wherever necessary, justify the same.

**1.a** With an example define the physical address, the internetwork address (IP address), the port address and application specific address. **5**

**1.b** Explain how H.323 uses G.71/ G.723.1, H.225, Q.931 and H.245 to establish and maintain voice (or video) communication. **5**

**1.c** Differentiate between subnetting and supernetting. **5**

**1.d** The following is a dump of a UDP header in hexadecimal format. **5**

CB840035001C001C

i) What is the source port number? ii) What is the destination port number?
iii) What is the total length of the user datagram? iv) What is the length of the data? v) Is the packet directed from a client to a server or vice versa?

**2.a** Explain the process of sending Email using message transfer agent. **10**

**2.b** Discuss the DHCP operation when the client and server are on the same network or on different networks. **10**

**3.a** Explain how TCP controls the congestion in the network using different strategies. **10**

**3.b** An ISP is granted a block of addresses starting with 150.80.0.0/16. The ISP wants to distribute these blocks to 2600 customers as follows: **10**

i) The first group has 200 medium-size businesses; each needs approximately 128 addresses.
ii) The second group has 400 small businesses; each needs approximately 16 addresses.
iii) The third group has 2000 households; each needs 4 addresses.

Design the subblocks and give the slash notation for each subblock. Find out how many addresses are still available after these allocations.

**4.a** Draw the general format of ICMP messages. Discuss the purpose of error-reporting and query messages. **10**

**4.b** Explain quality of service (QoS) and how it can be improved using scheduling techniques and traffic shaping techniques. **10**

**5.a** Discuss some characteristics of real-time audio/video communication. **10**

**5.b** Draw the IP header format and explain all fields in brief. **10**

**6** Write short note on: **20**

a) FTP b) Control field or flags of TCP c) Messages used in RTCP
d) TCP Timers

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**(3 Hours)** **[Total Marks: 80]**

**N.B.**
(1) **Question No.1** is compulsory
(2) **Attempt** any **three** questions from remaining questions.
(3) **Figures** to right indicate **full** marks

1. a) Explain the advantages and disadvantages of SONET/SDH **05**
   b) Compare Linear and Nonlinear Scattering **05**
   c) What is the Numerical Aperture of Fiber? Give its significance **05**
   d) What is Optical Circulator? Give its applications. **05**

2. a) Explain in brief intermodal and intramodal dispersion in fiber **10**

   b) A 6Km optical link consist of multimode step index fiber with a core refractive index of 1.5 and relative refractive index difference of 1%. Estimate **10**
   (i) Delay difference between slowest and fastest modes at the fiber output
   (ii) RMS pulse spreading due to intermodal dispersion on the link
   (iii) Maximum bit rate that may be obtained without substantial errors on the link assuming only intermodal dispersion
   (iv) Bandwidth Length product corresponding to (iii)

3. a) What are the different fiber fabrication methods? Explain double crucible method of fiber fabrication. **10**

   b) What is optical amplifier? Compare different types of optical amplifiers **10**

4. a) Explain in detail working principle of PIN photodetector. Explain its merits and demerits **10**

   b) What is OTN? Draw and explain its frame structure **10**

5. a) What are the advantages of OTDM? Explain its working principle **10**

   b) Discuss the term power penalty with suitable system model **10**

6. Write short notes on any two **20**
   a) Passive optical Network
   b) Dispersion compensation
   c) Performance and fault management in optical network
   d) Optical safety

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**(3 Hours)** **[Total Marks: 80]**

**N.B.**: (1) Question no 1 is compulsory
(2) Solve any three from remaining five
(3) Assume suitable data if required.
(4) Figures to the right indicate full marks.
(5) Draw neat diagrams wherever required.

| | | | |
|---|---|---|---|
| **1** | **(a)** | What is timing advance in GSM? | **05** |
| | **(b)** | Explain Foliage loss in propagation. | **05** |
| | **(c)** | What is cell dragging and dwell time? | **05** |
| | **(d)** | How handoffs are prioritized | **05** |
| **2.** | **(a)** | If bw=1.25MHz, R=9600 bps and minimum acceptable $E_b/N_0$ is found to be 10 dB determine the maximum no of users that can be supported in a single-cell CDMA system using a) omnidirectional base station antennas and no voice activity detection and b) 3 sectors at base station and activity detection with $\alpha$=3/8 assume the system is interference limited. | **10** |
| | **(b)** | Draw and explain 3GPP architecture | **10** |
| **3** | **(a)** | Draw and explain Signaling architecture of GSM. | **10** |
| | **(b)** | What is the concept of software Defined Radio | **10** |
| **4** | **(a)** | Classify small scale fading based on Multipath Time Delay Spread and Doppler spread and explain in brief each type. | **10** |
| | **(b)** | Explain Block Call delayed and Block Call cleared System | **10** |
| **5** | **(a)** | Draw reference architecture of GPRS and explain role of SGSN and GGSN | **10** |
| | **(b)** | Draw and explain IMT 2000 architecture | **10** |

**6.** Write short note on

**a)** MIMO technique in LTE

**b)** Rake Receiver

**c)** Power control in CDMA 2000 and WCDMA

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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.

Q.1

(a) What factors limit transistor use at microwave frequencies? [5]
(b) Explain Doppler shift and its role in CW radar. [5]
(c) Explain the working of Phase shifter. [5]
(d) Explain the principle of working of quarter wave transformer. [5]

Q.2

(a) Explain how avalanche devices operate. Name three devices that use the avalanche mode for their operation. [10]
(b) Design single-stub (short circuit) shunt tuning networks to match a load impedance $Z_L = 60 - j80\ \Omega$, to a 50 Ω line. Assuming that the load is matched at 2 GHz [10]

Q.3

(a) Explain the working of a negative resistance parametric amplifier. [10]
(b) Explain the concept of velocity modulation. Also explain the working of cylindrical magnetron. [10]

Q.4

(a) Derive equation for phase velocity, cutoff frequency, cutoff wavelength and field equations for rectangular waveguide. [10]
(b) Explain how avalanche devices operate. Name three devices that use the avalanche mode for their operation. [10]

Q.5

(a) Derive the Radar range equation as governed by minimum detectable signal to noise ratio. [10]
(b) Draw the functional block diagram of an MTI Radar system and explain its operation. Define the terms blind speed and MTI improvement factor. [10]

Q.6

(a) Instrument landing system. [5]
(b) Ferrite device Isolator [5]
(c) Hybrid ring [5]
(d) Modes in Gunn diode [5]

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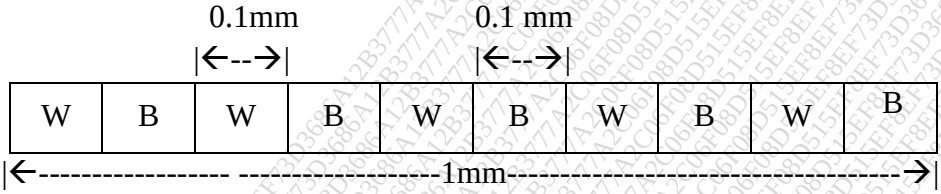
**Time: 3 Hrs** **Total marks: 80**

**Instructions**

1. Q1 is compulsory
2. Solve **any three** from remaining
3. Assume suitable data if necessary

Q1 Answer the following

1. Image resulting from poor illumination could be difficult to segment, State true or false, Justify your answer 4M
2. For given figure, Improve and reduce the spatial resolution, consider W= White line, B = Black line, Size of each white and black line is 0.1 mm, total length is 1 mm. 4M




3. Two images have same histogram which of the following properties must they have in common 1) same total power 2)same entropy 3) same inter pixel covariance function Justify your answer 4M
4. Compare 2-D motion and optical flow 4M
5. Draw and explain the model of image degradation/restoration process 4M

Q2

1. For given image find and equalize histogram 8M

| | | | |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 5 | 5 | 6 | 6 |
| 6 | 7 | 6 | 6 |
| 6 | 7 | 2 | 3 |

2. Explain 1) Contrast stretching 2) Log Transformation with neat diagrams 6M
3. Prove Periodicity and symmetry properties of DFT 6M

Q3

1. Apply 1) Averaging filter 2) Median filter on following image. Use pixel replication for padding. No marks if procedure not followed 8M

| | | |
|---|---|---|
| 4 | 8 | 9 |
| 12 | 15 | 18 |
| 30 | 32 | 46 |



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2. Explain 1) Sharpening using 2nd order derivative 2) Unsharp masking and high boost filtering 8M
3. Let V = {0,1} . Compute 1) Euclidean distance 2) City block distance 3) Chess board distance between pixels p and q 4M

| | | | |
|---|---|---|---|
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 (q) |
| 1 | 1 | 1 | 1 |
| 1 (p) | 1 | 1 | 1 |

Q4

1. Draw PDF and write equation for following noise models 6M
   a. Gaussian Noise b. Rayleigh noise c. Erlang noise
2. Apply bit plane slicing on following image

| | | |
|---|---|---|
| 5 | 7 | 5 |
| 4 | 6 | 3 |
| 1 | 3 | 2 |

3. Find the border for image F given below using two different structural elements A and B respectively 10M

F=

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |

A=

| | | |
|---|---|---|
| 0 | 1 | 0 |
| 1 | 1 | 1 |
| 0 | 1 | 0 |

B=

| | | |
|---|---|---|
| 1 | 1 | 1 |
| 1 | 1 | 1 |
| 1 | 1 | 1 |



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Q5

1. Classify video frames? What is GOP? 6M
2. Which are the digital quality measures? Explain any 2 6M
3. Find DCT of given image by finding kernel function 8M

| | | | |
|---|---|---|---|
| 4 | 2 | 2 | 1 |
| 2 | 5 | 8 | 9 |
| 2 | 4 | 5 | 2 |
| 2 | 3 | 2 | 2 |

Q6

1. Explain motion estimation criterion based on optical flow equation 10M
2. Write Short Notes on **any two** 10M
    1. Exhaustive block matching algorithms
    2. Binary Feature Matching
    3. Motion Representation

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**Duration: 3 Hours** **Marks: 80**

**Note:**

1) Q.1 is **compulsory**.
2) Attempt any **three** questions from the remaining **five** questions.
3) Assume Suitable data wherever necessary

Q.1 (a) In JPEG compression why DCT is the preferred transform? (20)
(b) State Fermat's theorem and describe its application in cryptography.
(c) Compare image and video compression concepts.
(d) What are 'active 'and 'passive' attacks on security system? List two attacks for each type.

Q.2 (a) Draw and explain the block diagram of JPEG2000 image compression standard. (10)

(b) Explain why RSA works? In a public-key system using RSA, you intercept the cipher text C = 10 sent to a user whose public key is e = 5, n = 35. What is the plaintext M? (10)

Q.3 (a) What is 'frequency' and 'temporal' masking? Explain how it is used and implemented in MP3 audio compression. (10)

(b) Explain Hash function. What characteristics are needed in a secure hash function? (10)

Q.4 (a) Encode and decode the sequence 'abababababaab' using LZW. Initial dictionary (a,b).Compare LZ77 and LZ78. (10)

(b)Describe Diffie-Hellman key exchange protocol and also a man-in-the-middle attack on the protocol. (10)

Q.5 (a) Consider a source with symbols = {m, n, o, p, q} with corresponding probabilities {0.1, 0.1, 0.2, 0.3, 0.3}. Using arithmetic coding, determine the output tag for the message "nqpo". Also, reconstruct the message using this tag. (10)

(b) Draw and explain the working of AES encryption algorithm. (10)

Q.6 (a) Explain μ Law and A Law Companding. How it is used in audio compression? (10)
(b) Write short notes(Any two)
(i) Chinese remainder theorem in cryptography (10)
(ii)Triple DES
(iii) Intruders and viruses

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