(3 hours)   **Total Marks: 80**

N.B.   1. Question **No. 1** is compulsory
2. Attempt any **three** out of remaining
3. Assume suitable data if **necessary** and justify the assumptions
4. Figures to the **right** indicate full marks

Q1   A   Evaluate DFT of $x(n)=\cos(0.25\prod n)$.   05

B   Determine the energy and power of signal given by $x(n) = (1/3)^n u(n)$.   05

C   Find the circular Convolution of the following causal signals   05
$x_1(n)= \{ 3, 2, 4, 1\}$ and $x_2(n)=\{ 2, 1, 3 \}$

D   Define BIBO Stable system.   05

Q2   A   State the following DFT properties: 10
1.Linearity
2.Periodicity
3.Scaling
4.Convolution
5.Time Reversal

B   Consider the following analog signal   10
$x(t)=5 \cos 2\prod (1000\ t) + 10 \cos 2\prod(5000t)$ to be sampled.
I) Evaluate the Nyquist rate for this signal.
II) If the signal is sampled at 4 kHz , will the signal be recovered from its samples?

Q3   A   For the causal LTI digital filter with impulse response given by   10

$h(n) = \delta(n) – 2\delta(n-1) + \delta(n-2) +2\delta(n-3)$ sketch the magnitude response of the

filter.

B   Design radix 2FFT flow graph for $x(n)=\{2, 1, 3, 1\}$ 10

Q4   A   Check whether the system $y[n] = x[n] + 2x[n-2]$ is: 10
i)Static or Dynamic
ii)Linear or Non-linear
iii)Causal or Non-Casual
iv) Shift variant or Shift Invariant

B   Compute linear convolution of the causal sequences $x[n]= \{3, 4, 2, 1, 2, 2, 1, 1\}$ 10
and $h[n]=\{1, -1\}$ using overlap add method.

[TURN OVER]

1

Q5 A For x(n) = {3, 2, 1, 6, 4, 5}, plot the following Discrete Time signals: 10

      1.) x(n+1)   2.) x(-n)u(-n)   3.) x(n-1)u(-n-1)

      4.) x(n-1)u(n)   5.) x(n-2)

   B Perform Cross correlation of the causal sequences   10
      x(n)= {3, 3, 1, 1 } y(n) = { 1, 2, 1}

Q6 A Write a detailed note on TMS 320   10

   B Explain the significance of Carl's Correlation Coefficient Algorithm in digital   10
      signal processing. Evaluate Carl's Coefficient for two causal sequences
      x[n]={1, 3, 4, 2} and y[n]={1, 2, 2, 1}.

_____

Time: 3 hours   Marks: 80

1. Q.1 is **compulsory**.
2. Attempt any **three** questions from the remaining **five** questions.

Q.1 (a) Discuss the concept of LZ78 with an example.   (5)
     (b) What is motion estimation? How is it useful for video compression?   (5)
     (c) Define Euler's totient function. Compute $\Phi(37)$, $\Phi(49)$, $\Phi(100)$.   (5)
     (d) Define hash function and state its properties.   (5)

Q.2 (a) Consider a source with symbols = {m, n, o, p} with corresponding probabilities   (10)
          {0.4, 0.3, 0.1, 0.2}. Using arithmetic coding, determine the output tag for the
          message "mnnop". Also, reconstruct the message using this tag.
     (b) Draw and explain the working of AES encryption algorithm.   (10)

Q.3 (a) Using RSA algorithm, user X chooses the public key ($n = 21$, $e = 5$). Compute the   (10)
          private key d of user X.
          User Y wants to transmit message $M = 19$ to user X in a confidential manner using
          RSA algorithm; determine the cipher text C.
     (b) Draw and explain the working of JPEG image compression standard.   (10)

Q.4 (a) Discuss the concept of μ-law companding. Using μ-law companding, determine   (10)
          the encoded output value for an input audio sample with value (+358). Also,
          reconstruct to determine the decoded value.
     (b) What is Certificate Authority? How is a digital certificate obtained and verified?   (10)

Q.5 (a) What is Intrusion Detection System? Discuss the different techniques of   (10)
          implementing it.
     (b) Solve the linear congruent equation for x: $232x + 42 \equiv 48 \bmod 50$.   (5)
     (c) How is the accumulation of error avoided when using DPCM for image   (5)
          compression?

Q.6 (a) Draw and explain the working of Key Distribution Center for exchanging secret   (10)
          keys.
     (b) Compare statistical and dictionary compression techniques.   (5)
     (c) What is a one-way trapdoor function? List three one-way trapdoor functions used   (5)
          in cryptography.

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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 the right indicate full marks

 (4)Assume suitable data if necessary and mention the same in answer

 sheet.

Q.1   Attempt any 5 questions   [20]
  a) Explain three operating windows in optical communication

  b) Compare between intermodal and intramodal dispersion.
  c) Differentiate LED and LASER sources
  d) Explain the working principle of optical circulator.
  e) What is Optical amplifier?
  f) Define Cross talk and Solitons.

Q.2   a) A silica optical fiber has core refractive index of 1.4 and the cladding index   [10]
  of refraction is 1.35 .Determine
  i)The critical angle
  ii)Numerical aperture
  iii) The acceptance angle
  b) Explain the signal attenuation in optical fiber and plot the three windows   [10]
Q.3   a) Explain sources of loss at fiber joint.   [10]
  b) Explain any one fiber fabrication process with neat diagram. Compare the   [10]
  different methods of fabrication.

Q.4   a) Derive an expression for Link Power Budget analysis of optical fiber.   [10]
  b) Explain principle of working of APD photo detector.   [5]
  c) Define Self phase modulation   [5]
Q.5   a) Explain SONET architecture in detail.   [10]
  b) Explain important network management functions to the operation of the   [10]
  Network.

Q.6   Short notes on: (Attempt any four)   [20]
  a) Fiber Bragg grating
  b) WDM network and architecture
  c) Four wave mixing
  d) Optical Access Network
  e) OTDM

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(3 Hours) [Total marks: 80]

Note:

1) Question no. 1 is compulsory.
2) Write any three questions from remaining five questions.
3) Assume suitable data if necessary.

Q.1

(20)

a. What is near far problem in CDMA how to overcome it?
b. Explain call procedure in GSM for network to mobile terminated call.
c. What is node B, explain its responsibilities.
d. What are the factors influencing Small scale fading?
e. If a total of 33 MHz of bandwidth is allocated to a particular FDD cellular telephone system which uses two 25 kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (a) four-cell reuse, (b) seven-cell reuse, and (c) 12-cell reuse.

Q.2 (20)

a. Sketch UMTS Network Architecture and explain it in detail.
b. Compare IS95, WCDMA and CDMA2000.

Q.3 (20)

a. Describe algorithms used for authentication & security in GSM with diagrams.
b. Draw reference architecture in GPRS and explain role of GGSN and SGSN.

Q.4 (20)

a. Explain the use of two ray Model to explain Mobile Radio Path Loss and Antenna Height Effects?
b. Consider a cellular system in which total available voice channels to handle the traffic are 960. The area of each cell is $6 Km^2$ and the total coverage area of the system is 2000KM2. Calculate
1) The system capacity if the cluster size, N=4
2) The system capacity if the cluster size, N=7
How many times would a cluster of size 4 have to be replicated to cover the entire cellular area?
Does decreasing the reuse factor N increase the system capacity? Justify your answer.

Q.5 (20)

a. How RAKE receiver improves S/N ratio in CDMA also explain why power control on the reverse channel is essential?

b. A Base station has a 900 MHz transmitter and a vehicle is moving at the speed of 50 kmph. Compute the received carrier frequency if the vehicle is moving: (i) Directly towards the BS, (ii) Directly away from the BS, (iii) In a direction that is 60° to the direction of arrival of the transmitted signal?

Q.6 (20)

a. Describe the concept of software defined radio, Explain it in detail.

b. Sketch and Explain LTE network architecture and various interfaces.

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Time : 3hrs   **Max. Marks: 80**

N.B:
1. **Question No.1** is compulsory
2. Attempt any **three** out of remaining **five** questions
3. Assume any suitable data wherever required but justify the same
4. Illustrate answers with neat sketches wherever required

....

Q.1   a)   Define with diagram, perspective projection   (05)

b)   What are the advantages and disadvantages of edge based   (05)
segmentation?

c)   What is the basic idea of Histogram modeling?   (05)

d)   Write video frame classification & various digital video formats.   (05)

Q. 2   a)   State properties of Fourier Transform and prove convolution   (10)
property of Fourier transform.
b)   Given orthogonal kernel matrix A and image U: (10)

A =   1/√2
1	1
1	-1

U =
1	2
3	4

Find transformed image and basis image

Q. 3   a)   Compare histogram equalization, histogram specification and   (10)
contrast stretching with example.

b)   For 3 bit, 4x4 image, perform image negative, Bit plane slicing,   (10)
And low pass filtering

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

Q. 4   a)   Explain split and merge segmentation technique   (10)
b)   Elaborate Hit or Miss transform with example   (10)

Page **1** of **2**

Differentiate between image enhancement and restoration

Q. 5 a) Explain application of Wiener filter   (10)

b) Which are different motion estimation techniques?   (10)
    Explain any one technique in detail.

Q. 6   Write short notes on any four.   (20)

a) Opening and Closing

b) Homomorphic Filtering

c) Inverse filter

d) Image noise models

e) Hierarchical block matching algorithm

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Time: 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 is meant by RADAR range?   (05)
      (B) Discuss the characteristics of microwaves.   (05)
      (C) Given the circuit shown in Fig. 1(C), design a lumped element matching network (10)
           at 60 MHz that would transform Load impedance Z_L = 100 - j25 Ω into an input
           impedance of Z = 25 + j15 Ω. Take Z_0 = 50 Ω.

Matching network
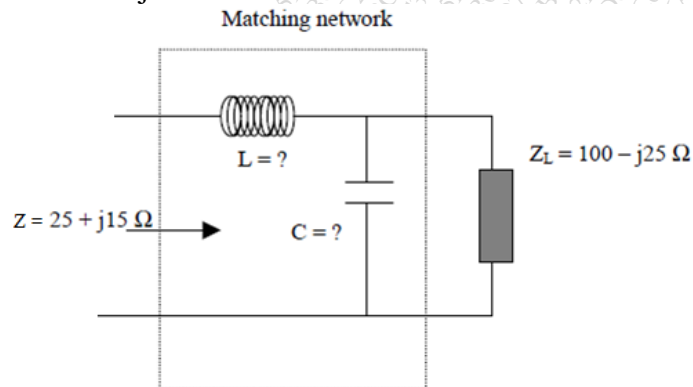

Fig. 1(C)

Q.2. (A) With a neat functional diagram explain the working principle of Cylindrical   (10)
           Magnetron.
      (B) Write a short note on circular waveguide.   (10)

Q.3. (A) Explain working of TRAPATT.   (10)
      (B) Radar operating at 1.5 GHz uses a peak pulse power of 2.5 MW and has a range (10)
           of 100 nmi for objects whose radar cross section is 1 m^2. If the minimum
           receivable power of the receiver is 2×10^{-13} Watt, what is the smallest diameter
           of the antenna reflector could have assuming it to be a full paraboloid with
           η=0.65.

Q.4. (A) Explain any one bio-medical application using microwave.   (10)
      (B) Match a load impedance Z_L=60-j80 to a 50 Ω line using a double stub tuner. The (10)
           stubs are open circuited and are spaced λ/8 apart. The match frequency is 2 GHz.

Q.5. (A) With block diagram explain the MTI radar system. Give its limitations.   (10)
      (B) Explain Doppler Shift and its role in pulsed and CW RADAR.   (10)

Q.6.   Write a short note on following: (05)
      (A) Phase shifters   (05)
      (B) Reflex Klystron   (05)
      (C) Gunn diode   (05)
      (D) Clutter

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