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Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Microwaves and Antennas

Time: 3 hrs.   Max. Marks: 80

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Smith chart are permitted.

Module-1

1   a. Describe basic principle and working mechanism of oscillation in Reflex Klystron through Apple gate diagram. **(06 Marks)**
    b. What is reflection co-efficient? Obtain an expression for the same. How it is related to standing wave ratio. **(06 Marks)**
    c. A microwave transmission line has a characteristic impedance of $Z_0 = 100 \lfloor 53.13° \Omega$ when it is terminated in a unknown load impedance Z_L, the transmission coefficient was observed to be $1.09 \lfloor 35.34°$. Find :
        i) Reflection coefficient
        ii) Terminating load impedance Z_L. **(04 Marks)**

OR

2   a. What are standing waves? How are they formed? Obtain expression for voltage standing wave and phase pattern of travelling wave. **(06 Marks)**
    b. A load impedance of $Z_L = 60 - j80\Omega$ is required to be matched to a 50Ω co-axial line by using a short circuited stub length 'ℓ' located at a distance 'd' from the load. The wave length of operation is 1 mtr. Using Smith chart find 'd' and 'ℓ'. **(06 Marks)**
    c. Obtain expression for line impedance interms of reflection coefficient. **(04 Marks)**

Module-2

3   a. Explain with neat sketches the construction and operation of a precision type variable attenuator. **(06 Marks)**
    b. Consider a losses H-plane TeeJunction with 50mw of power being fed into port(1) and other two ports(2) and (3) are terminated in matched termination. Calculate the power fed into each of the ports by the junction. **(04 Marks)**
    c. Discuss applications of Magic Tee. **(06 Marks)**

OR

4   a. Explain with neat sketches the construction and operation of a H-plane TeeJunction. List the characteristics and hence derive its S Matrix. **(10 Marks)**
    b. Give relations of Z, Y and ABCD parameter with S-parameter. **(06 Marks)**

Module-3

5   a. What are the losses encountered in microstriplines? Discuss briefly. **(06 Marks)**
    b. Find the directivity for the following pattern :
        i) Bidirectional sine squared pattern
        ii) Unidirectional cosine squared pattern. **(06 Marks)**
    c. Find the solid angle Ω in square degrees on a spherical surface for θ ranging between 20° and 40° and ϕ ranging between 30° and 70°. **(04 Marks)**

OR

6 a. Derive an expression for Aem for short dipole. **(06 Marks)**
   b. Obtain an expression for FRIS transmission formula used in radio communication link.
(06 Marks)
   c. The normalized field pattern of an antenna is given by $E_n = \sin\theta \sin\phi$ where θ and ϕ ranges between 0 and e_{total}. Find the directivity by accurate method and approximate method.
(04 Marks)

Module-4

7 a. Drive an expression for e total, peaks array factor, side lobes and nulls for linear uniform array for N-isotropic point sources of equal amplitude and spacing. **(06 Marks)**
   b. Obtain an expression for radiation resistance of dipole. **(06 Marks)**
   c. Find length of half wave dipole at 30 MHz. **(04 Marks)**

OR

8 a. Explain various forms of antenna arrays with neat diagram. **(06 Marks)**
   b. A linear array consists of 4 isotropic point sources. The distance between adjacent element $\lambda/2$. The power applied with equal magnitude and phase difference $- d_r$ obtain field pattern and find BWFN and HPBW. **(10 Marks)**

Module-5

9 a. Derive expression for field component for general loop antenna. **(06 Marks)**
   b. Write general characteristics of Yagi-Uda Antenna. **(04 Marks)**
   c. Calculate directivity of 20 turn helix with $\alpha = 12°$ and circumstances equal to one wave length.
(06 Marks)

OR

10 a. With neat sketch, explain design equation of Horn Antenna. **(06 Marks)**
    b. Write short note on :
       i) Helical antenna
       ii) Log periodic antenna. **(06 Marks)**
    c. Calculate the horn parameters :
       i) Length L
       ii) Width a
       iii) Flare angle θ
       iv) Flare angle ϕ
       If the month height b is 10λ.
       The horn is fed by a rectangular wave guide with TE_{10} mode. **(04 Marks)**

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CBCS SCHEME

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Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Digital Image Processing

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. What is Digital Image Processing? Explain in brief. **(02 Marks)**
    b. With a neat block diagram, describe the fundamental steps used in image processing. **(10 Marks)**
    c. Describe briefly the principle of image formation in the human eye. **(04 Marks)**

OR

2   a. Define 4-adjacency, 8- adjacency and m- adjacency. **(06 Marks)**
    b. Consider the image segment shown in Fig.Q2(b).
        i)   Let V = {0, 1, 2} and compute the length of shortest 4, 8 and m – paths between p and q. If a particular path does not exist between these two points explain why?
        ii) Repeat for V = {2, 3, 4}

3	4	1	2	0	
0	1	0	4	2	(q)
2	2	3	1	4	
3	0	4	2	1	
1	2	0	3	4	

(p)

Fig.Q2(b) **(10 Marks)**

Module-2

3   a. With the help of neat graphical illustration, explain the following basic intensity transformations with their applications.
        i)   Image negative
        ii) Log transformations
        iii) Power law transformations. **(10 Marks)**
    b. Explain Histogram matching technique. **(06 Marks)**

OR

4   a. What is homomorphic filtering? With block diagram, explain the homomorphic filtering approach used for image enhancement. **(10 Marks)**
    b. Name and explain any three properties of two dimensional discrete Fourier transform. **(06 Marks)**

Module-3

5   a. Define the process of image restoration. Draw and explain image degradation and restoration model. **(05 Marks)**
    b. Discuss adaptive median filter used in image restoration system. **(05 Marks)**
    c. Explain inverse filtering used in image Restoration process. List its limitations. **(06 Marks)**

OR

6 a. Name the commonly used noise probability density functions in digital image processing and explain any four of them. **(08 Marks)**
   b. Explain Wiener filtering/minimum mean square error used in image processing. **(08 Marks)**

Module-4

7 a. Explain color conversion from RGB to HIS and form HIS to RGB. **(08 Marks)**
   b. What is pseudo color image processing? Explain intensity slicing technique of pseudo color image processing with geometric interpretation diagram. **(08 Marks)**

OR

8 a. With necessary diagram, explain the two band sub band coding and decoding system with its spectrum with its spectrum splitting properties used in multi-resolution analysis. **(08 Marks)**
   b. With necessary diagrams describe the erosion and Dilatio process of morphological image processing. **(08 Marks)**

Module-5

9 a. Describe the canny edge detector algorithm with its basic objectives used in image edge detection process. **(08 Marks)**
   b. Explain the optimum global thresholding using Otsu's algorithm used in image segmentation process. **(08 Marks)**

OR

10 a. Explain the following representation approaches
       i) Boundary following
       ii) Chain codes. **(08 Marks)**
    b. Explain the following boundary descriptors
       i) Shape number
       ii) Fourier descriptor. **(08 Marks)**

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CBCS SCHEME

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Power Electronics

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a. Draw the control characteristics of the following:
   i) SCR   ii) GTO   iii) MCT   iv) IGBT   **(08 Marks)**
   b. What are the peripheral effects of power electronics equipment and mention how to overcome it?   **(08 Marks)**

OR

2   a. Explain different types of power electronics converter circuits with input and output waveforms   **(08 Marks)**
   b. Explain the switching characteristics of IGBT and mention its advantages.   **(08 Marks)**

Module-2

3   a. Explain two-transistor analogy of SCR.   **(08 Marks)**
   b. i) Explain the need for dv/dt and di/dt protection for SCR.
      ii) A SCR circuit has the following data: v_s = 200v, dv/dt = 100v/µs, di/dt = 50 A/µs. Calculate the snubber circuit components.   **(08 Marks)**

OR

4   a. Discuss dynamic turn-on and turn-off characteristics of SCR.   **(08 Marks)**
   b. With neat circuit diagram, explain the working of class-A self commutation with relevant waveforms.   **(08 Marks)**

Module-3

5   a. Explain the operation of single-phase full converter with neat circuit diagram and waveform. Derive expression for average and rms output voltage.   **(08 Marks)**
   b. i) Explain how a dual-converter works in all four quadrants.
      ii) A single phase dual converter is operated from a 120V, 50Hz supply and the load resistance R = 10Ω. The circulating inductance is L_r = 40mH. Delay angles are α_1 = 60° and α_2 = 120°. Calculate the peak circulating current and the peak current of converter 1.   **(08 Marks)**

OR

6   a. Explain the principles of ON-OFF control for single-phase AC voltage controller. Draw the circuit and relevant waveforms.   **(08 Marks)**
   b. A single phase full converter working on ON-OFF control technique has supply voltage of 230V RMS, 50Hz, load = 50Ω. The controller is ON for 30 cycles and OFF for 40 cycles. Calculate:
   i) ON and OFF time intervals
   ii) RMS output voltage
   iii) Input pf
   iv) Avg and rms thyristor currents.   **(08 Marks)**

Module-4

7 a. Explain the working of step down choppers with waveforms and derive the expression for output voltage. **(08 Marks)**

  b. Explain the working of boost-regulator and derive expression for average output voltage. **(08 Marks)**

OR

8 a. Explain the principle of step-up chopper. Derive expression for output voltage. **(08 Marks)**

  b. I. Explain four quadrant operation of chopper.

  II. Consider the switch, to be ideal in the circuit of Fig.Q.8(b), determine:

  i) Duty cycle K for which $V_{0\,av} = V_{0,rms}$

  ii) The chopper efficiency
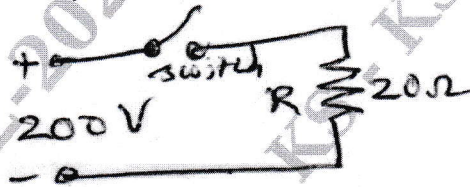
Fig.Q.8(b)

(08 Marks)

Module-5

9 a. Explain the performance parameters of inverters. **(08 Marks)**

  b. i) Give comparison between voltage source inverter and current source inverter.

  ii) Explain half bridge inverter with inductive load. **(08 Marks)**

OR

10 a. Explain the working of transistorized current source inverter. **(08 Marks)**

  b. i) Explain with neat circuit variable dc link inverter. Mention its advantages and disadvantages.

  ii) Considering a single phase bridge inverter if $V_s = 200v$ and $V_{01(rms)}$ is 90V, determine the delay angle β. **(08 Marks)**

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2 of 2

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Multimedia Communication

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. List out the different types of multimedia networks used to provide Multimedia services.
       (03 Marks)

    b. With a neat diagram, explain Telephone Network and Broadcast Television Network.
       (08 Marks)

    c. Determine the propagation delay associated with the following communication channels. Assume that the velocity of propagation of a signal in the case of i) 4   ii) is $2 \times 10^8 ms^{-1}$ and iii) is $3 \times 10^8 ms^{-1}$.
       1. A connection through a private network of 1km
       2. A connection through a PSTN of 200km
       3. A connection over a satellite channel of 50,000km.   **(05 Marks)**

OR

2   a. Find the maximum block size that should be used over a channel which has mean BER probability of 10^{-4}. If the probability of a block containing an error and hence discarded to be 10^{-1}.
       (03 Marks)

    b. Describe the additional service provided by public and private networks other than telephony.
       (08 Marks)

    c. With a neat diagram, explain the Image only Interpersonal communication.   **(05 Marks)**

Module-2

3   a. With a neat diagram, explain the signal encoding and decoding using PCM principles.
       (09 Marks)

    b. Assuming the bandwidth of a speech signal is from 50Hz through to 10KHz and that of a music signal is from 15Hz through to 20KHz, determine procedure in each case assuming Nyquist sampling rate is used with 12bits per sample for the speech signal and 16bits per sample for music signal. Derive the memory required to store a 10 minute passage of a stereophonic music.
       (07 Marks)

OR

4   a. Explain 4:2:2 and 4:2:0 digitization formats.   **(08 Marks)**

    b. Describe with a neat schematic color image capture using Digital Camera and Scanner.
       (08 Marks)

Module-3

5   a. Describe GIF (Graphic Interchange Format) with relevant diagrams and also describe the modes.
       (08 Marks)

    b. Derive the code for string "went." Comprising characters with probability of e = 0.3, n = 0.3, t = 0.2, w = 0.1, ● = 0.1 using Arithmetic coding.   **(08 Marks)**

OR

6 a. With a net Schematic, explain JPEG Encoder.   **(09 Marks)**
   b. Derive the output code using LZW compression algorithm. The input string is ABABBABCABABBA for the initial dictionary containing only three characters with code as follows :

   Code   String
   1   A
   2   B
   3   C

                                                                                      (07 Marks)

Module-4

7 a. Explain with a neat diagram, ADPCM sub band encoder and decoder.   **(08 Marks)**
   b. Explain with relevant diagrams, sensitivity of the ear, frequency and temporal masking used in perceptual coding.   **(08 Marks)**

OR

8 a. Illustrate with a neat diagram, Dolby AC -2 and hybrid backward/forward adaptive bit allocation.   **(08 Marks)**
   b. Explain the principles of video compression and also different frame types used.   **(08 Marks)**

Module-5

9 a. Explain the NTI and CTI reconstruction schemes.   **(08 Marks)**
   b. Discuss the network design issues that directly affect video transmission.   **(08 Marks)**

OR

10 a. Discuss Simulcast coder and layered coder in layered compression.   **(08 Marks)**
    b. Explain with block diagram, the video streaming architecture.   **(08 Marks)**

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15EC744

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Cryptography

Time: 3 hrs.

Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. List all the axioms that should be obeyed by a field. Give suitable examples for fields.

(08 Marks)

   b. Find the GCD of the following pairs of numbers using Euclid's algorithm :
   i) (24140, 16762)   ii) (4655, 12075).

(08 Marks)

OR

2   a. Explain the extended Euclid's algorithm to determine the multiplicative inverse of a given integer 'a' under modulo 'b'. Then determine 37^{-1} mod 49 using the algorithm.   **(06 Marks)**

   b. Find the GCD of the polynomials $x^8 + x^5 + x^4 + x + 1$ and $x^7 + x^6 + x^5 + x + 1$ using Euclidean algorithm.

(05 Marks)

   c. Prepare tables to demonstrate addition and multiplication operations for GF(5), and hence find the additive and multiplicative inverses modulo 5.

(05 Marks)

Module-2

3   a. What are mono-alphabetic ciphers? Explain with an example. Discuss in brief the cryptanalysis of mono-alphabetic ciphers.

(06 Marks)

   b. State the rules used for encryption in PLAYFAIR cipher and encrypt the message "WATER SCARCITY" using the keyword "SAVE" using PLAYFAIR cipher.

(08 Marks)

   c. Decrypt the cipher text "zh 2100 phhw" using Caesar cipher.

(02 Marks)

OR

4   a. Encrypt the message "HILLCIPHER" using the key $\begin{bmatrix} 3 & 2 \\ 8 & 5 \end{bmatrix}$ using Hill cipher.   **(06 Marks)**

   b. Encrypt the message "WORK IS WORSHIP" using the key "MOTIVATION" using vigenere cipher.

(04 Marks)

   c. With a neat block diagram, explain the various steps involved in encryption and key generation of DES algorithm.

(06 Marks)

Module-3

5   a. Explain the AES encryption process with a neat flow diagram.   **(08 Marks)**

   b. Demonstrate the following operations in AES encryption given the input state 'S'

$$S = \begin{bmatrix} 87 & F2 & 4D & 97 \\ EC & 6E & 4C & 90 \\ 4A & C3 & 46 & E7 \\ 8C & D8 & 95 & A6 \end{bmatrix}$$

and write the outcomes of each and transformation matrix is :

$$\begin{bmatrix} 2 & 3 & 1 & 1 \\ 1 & 2 & 3 & 1 \\ 1 & 1 & 2 & 3 \\ 3 & 1 & 1 & 2 \end{bmatrix}$$

i) Shift rows   ii) Mix columns.

(08 Marks)

OR

6 a. Write briefly about :
      i) Linear Congruential generators
      ii) Galois - linear feedback shift register. **(06 Marks)**

   b. With neat diagrams and necessary equations explain the working of :
      i) Geffe generator
      ii) Gellmann cascade generator. **(10 Marks)**

Module-4

7 a. If 'n' is a composite number and passes the Miller – Rabin test for the base 'a', then 'n' is called a strong pseudo – prime to the base 'a' show that 2047 is a strong pseudo – prime to the base 2. **(04 Marks)**

   b. State Fermat's and Euler's theorems and bring out the differences between the two. Also find 9^{794} mod 73 using the most relevant of the two theorems. **(06 Marks)**

   c. There is a number whose value is unknown. Repeatedly divided by 5 the remainder is 3; when divided by 7 the remainder is 1; and when repeatedly divided by 8 the reminder is 6. What is the number? (Hint : Use CRT). **(06 Marks)**

OR

8 a. Using the RSA algorithm, determine the private key 'd' (or PR) and the message 'M' given the cipher text C = 66, n = 119 and public key is PU = (e = 5, 119). **(05 Marks)**

   b. Give the geometric and algebraic description of addition of 2 points $P(x_1, y_1)$ and $Q(x_2, y_2)$ on an elliptic curve $E_p(a, b)$ over prime numbers. **(06 Marks)**

   c. Consider a Diffie – Hellman scheme with a common prime q = 11 and a primitive 'α' = 2.
      i) If user 'A' has public key $Y_A = 9$, what is A's private key?
      ii) If user 'B' has public key $Y_B = 3$, what is the shared secret key 'K'? **(05 Marks)**

Module-5

9 a. With neat diagrams and related equations explain a single operation of the Secure Hash Algorithm (SHA). Common on its security. **(08 Marks)**

   b. Explain briefly the process of prime number generation in the DSA algorithm. **(08 Marks)**

OR

10 a. Define one way hash functions. Mention its properties. **(04 Marks)**

    b. Describe briefly discrete logarithm signature schemes. **(06 Marks)**

    c. Explain the operation of MD5, with neat diagrams and relevant equations. **(06 Marks)**

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Seventh Semester B.E. Degree Examination, Jan./Feb.2021
Satellite Communication

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a.   Describe Kepler's three law's and give relevant mathematical expressions. **(10 Marks)**
    b.   Discuss the following parameters with reference to satellite orbits:
         (i) Apogee and Perigee   (ii) Eccentricity   (iii) Equinoxes and Solistics. **(06 Marks)**

OR

2   a.   Explain orbital effects on satellites performance. **(08 Marks)**
    b.   Explain Antenna look angles : (i) Azimuth angle   (ii) Elevation angle. **(08 Marks)**

Module-2

3   a.   Describe TT and C subsystem with suitable diagrams. **(10 Marks)**
    b.   Discuss in brief attitude and orbit control. **(06 Marks)**

OR

4   a.   Explain in detail the types of Earth stations on the basis of services provided by them.
         (08 Marks)
    b.   Discuss in brief Earth Station Architecture. **(08 Marks)**

Module-3

5   a.   Explain the concept of FDMA with suitable diagram. **(08 Marks)**
    b.   Discuss in brief transmission path for SCPC systems. **(08 Marks)**

OR

6   a.   Explain in brief satellite link parameters :
         (i)   Choice of operating frequency.
         (ii)   Propagation considerations. **(08 Marks)**
    b.   Compute the free-space path loss in decibels for the following conditions:
         (i)   For a path length of 10 km at 4 GHz operating frequency.
         (ii)   Earth station transmitting antenna EIRP = 50 dBW, Satellite receiving antenna
                 gain = 20 dB and received power at satellite = –120 dBW. **(08 Marks)**

Module-4

7   a.   Explain with a neat block diagram, basic elements of a satellite communication system.
         (08 Marks)
    b.   Illustrate transparent transponders with suitable diagrams and explain performance
         parameters. **(08 Marks)**

OR

8   a.   Discuss in brief advantages and disadvantages of satellites over Terrestrial networks.
         (08 Marks)
    b.   Explain with a neat diagram, satellite point-to-point telephone networks. **(08 Marks)**

Module-5

9 a. Discuss in brief uplink section of satellite TV networks. **(08 Marks)**

   b. Explain in detail VSAT network topologies. **(08 Marks)**

OR

10 a. Discuss various types of sensors on board remote sensing satellites. **(06 Marks)**

   b. Discuss in brief image interpretation and application of remote sensing satellites. **(12 Marks)**

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Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Cryptography and Network Security

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a. Explain the Euclidean algorithm.   (08 Marks)
    b. Explain the Fermat's and Euler's theorem.   (08 Marks)

OR

2   a. What is Cryptanalysis? Explain any three general types of cryptanalysis attacks.   (08 Marks)
    b. Explain the substitution ciphers and transposition ciphers.   (08 Marks)

Module-2

3   a. Explain with neat diagram general depiction of DES encryption algorithm.   (06 Marks)
    b. With a block diagram, explain AES encryption and decryption algorithm.   (10 Marks)

OR

4   a. Explain the RSA algorithm in detail.   (08 Marks)
    b. Explain elaborately Diffie-Hellman key exchange.   (08 Marks)

Module-3

5   a. With a schematic, explain the outline and one processing stage of N-Hash function.
                                                                 (08 Marks)
    b. With a schematic, explain secure hash algorithm in detail.   (08 Marks)

OR

6   a. Explain the digital signature algorithm. Also explain the singing and verifying function of digital signature algorithm.   (10 Marks)
    b. Explain the discrete logarithm signature schemes.   (06 Marks)

Module-4

7   a. Elucidate TLS Architecture.   (08 Marks)
    b. Discuss HTTPs.   (08 Marks)

OR

8   a. Explain the SSH protocol stack.   (08 Marks)
    b. Explain the IEEE 802.11i phases of operation.   (08 Marks)

Module-5

9   a. Explain the pretty good privacy protocol.   (06 Marks)
    b. With a neat diagram, explain the simplified S/MIME functional flow.   (10 Marks)

OR

10 a. Explain the benefits of IP security.   (06 Marks)
    b. Explain IP security architecture.   (10 Marks)

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Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Satellite Communication and Remote Sensing

Time: 3 hrs.

Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain the main components of remote sensing with neat diagram.   (08 Marks)
   b. Explain briefly the milestones in remote sensing observation.   (08 Marks)

OR

2 a. Explain international space law.   (08 Marks)
   b. Explain the historical background of remote sensing systems.   (08 Marks)

Module-2

3 a. Explain the major spectral bands within the electromagnetic spectrum.   (08 Marks)
   b. Explain main factors affecting spectral signature.   (08 Marks)

OR

4 a. Explain the thermal properties of soil vegetation and thermal signature.   (08 Marks)
   b. Explain the electromagnetic laws with relevant expressions.   (08 Marks)

Module-3

5 a. Define resolution of a sensor system. Briefly describe different types of resolutions.   (08 Marks)
   b. Distinguish between passive and active sensors used in remote sensing.   (08 Marks)

OR

6 a. With the help of neat diagram, explain the principle of radar and lidar with respect to remote scanning.   (08 Marks)
   b. Explain the importance of satellite remote sensing missions.   (08 Marks)

Module-4

7 a. Explain the various constraints in using remote sensing data.   (08 Marks)
   b. Describe the organization of remote sensing projects.   (08 Marks)

OR

8 a. With the help of a neat diagram explain the generalized procedure for interpretation of remote sensing imagery.   (08 Marks)
   b. Explain the different approaches to interpret digital values acquired.   (08 Marks)

Module-5

9 a. With the help of a neat diagram, explain hierarchical organization of visual interpretation criteria.   (08 Marks)
   b. Explain how shadows help in object recognition with the help of a neat diagram.   (08 Marks)

OR

10 a. Explain color composite and temporal approaches in remote sensing.   (08 Marks)
    b. Explain feature identification in respect of visual interpretation   (08 Marks)

USN ☐☐☐☐☐☐☐☐☐☐   **15TE73**

Seventh Semester B.E. Degree Examination, Jan./Feb.2021
CMOS VLSI Design

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. Explain the DC transfer characteristics of CMOS inverter and mark all the regions of operation with necessary expressions for V_{Out} in each region. **(08 Marks)**
    b. Explain with a neat diagram, enhancement mode transistor action of nMOS transistor. **(08 Marks)**

OR

2   a. Using neat diagram, describe fabrication steps for n-MOS transistor. **(08 Marks)**
    b. Elaborate the concept of n-well fabrication with neat sketches. **(08 Marks)**

Module-2

3   a. List the colour, stick encoding, mask layout encoding for n-diffusion, P-diffusion polysilicon, metal 1. **(08 Marks)**
    b. With the truth table, draw the schematic, stick diagram and physical layout for 2 : 1 mux. **(08 Marks)**

OR

4   a. Describe the delay unit τ in terms of sheet resistance and area capacitance for the CMOS inverter pair shown in Fig. Q4 (a). Calculate the total delay. **(08 Marks)**

Fig. Q4 (a)

    b. Calculate the area of capacitance of a multilayer structure shown in Fig. Q4 (b), if feature size = 5 μm and relative value of metal to substrate = 0.075, polysilicon = 0.1, diffusion = 0.25. **(08 Marks)**
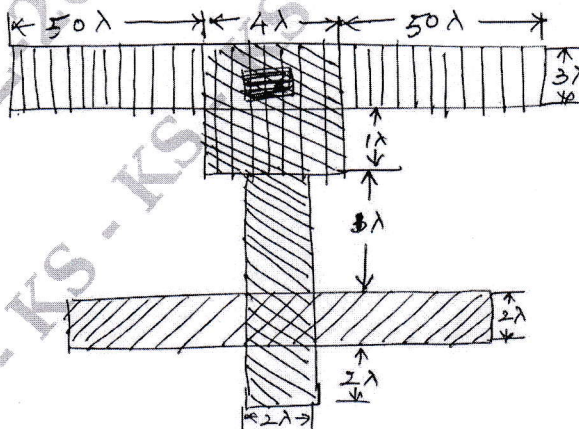

Fig. Q4 (b)

Module-3

5 a. What are the scaling factors for the following device parameters:
   (i) Gate capacitance C_g (ii) Max-operating frequency f_0
   (iii) Current density (iv) Power dissipation per gate P_g. **(08 Marks)**
   b. Discuss general considerations in the design of subsystem design process. **(08 Marks)**

OR

6 a. How to implement arithmetic and logic operation with a standard adder? Explain with the help of logic expression. **(08 Marks)**
   b. Explain FPGA architecture using block diagram. **(08 Marks)**

Module-4

7 a. Give the basic concept of parity generator and draw its stick diagram, using n-MOS technology. **(10 Marks)**
   b. Obtain the logic implementation of 4-way multiplexer (selector) using nMOS switches with necessary diagrams. **(06 Marks)**

OR

8 a. Discuss the architectural issues to be followed in the design of a VLSI subsystem. **(08 Marks)**
   b. Discuss carry look ahead adder with suitable equations and structure design. **(08 Marks)**

Module-5

9 a. Discuss the various system timing considerations. **(04 Marks)**
   b. Explain 3 transistor dynamic RAM cell. **(06 Marks)**
   c. Draw the schematic of 6 transistor SRAM cell. Discuss read/write operations with appropriate schematic diagrams. **(06 Marks)**

OR

10 a. Mention the types of I/O pads and discuss their functionalities. **(08 Marks)**
    b. What are the ground rules for successful design? **(08 Marks)**

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