KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 4th Year 1st Term Examination, 2017

Department of Electronics and Communication Engineering

ECE-4101

(VLSI Design and Nanotechnology)

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) What is Elmore delay? Estimate the rising and falling propagation delay and also contamination propagation delay of 4 input NAND driving *h* identical gates. (10)

   b) Explain the well and channel formation process of IC fabrication using necessary diagrams. (10)

   c) Design an pseudo nMOS inverter given the following specifications: (15)

$$V_{DD} = 2.5\ V,\ \ K'_n = 100\mu A/V^2$$
$$V_L = 0.2\ V,\ \ V_{T\Delta} = 0.75\ V$$
$$I_{DD} = 80\mu A,\ \ \gamma = 0.5\sqrt{V}$$
$$2\varphi_F = 0.6\ V$$

   Also find out the noise margin and draw VTC curve of it.

2. a) Determine the static and dynamic power dissipation during the process of charging and discharging the load capacitance in CMOS inverter. (13)

   b) What is the significance of gate capacitance in MOSFET? Briefly explain the behavior of gate capacitance model in cutoff, linear, and saturation regions of MOSFET. (12)

   c) Design CMOS digital logic circuit that realize the Boolean functions: (10)

$$i)\ y = a + bc$$
$$ii)\ y = \overline{ab + cd}$$

   Also draw equivalent RC circuits each of them.

3. a) What is PLD? What are the advantages of reducing the number of ICs using PLD? (08)

   b) Design ROM, PAL at a gate level and PLA using pseudo nMOS NOR-NOR to realize the following SOP functions. (15)

$$Q_0 = A + B\overline{C}$$
$$Q_1 = AB\overline{C} + A\overline{B}C$$
$$Q_2 = AB + \overline{B}\overline{C}$$

   c) What is GAL? Explain the GAL macrocell using necessary diagrams. (12)

4. a) What is FPGA? Classify of it. (06)

   b) What is ROM? Discuss on different techniques used to program ROM paths. (09)

   c) What is LUT? Design gate level structure of the following SOP function and also implement of it by LUT: (12)

$$f_1 = (abc + def)(g + h + i)(jk + lm)$$

   d) Draw the design flow diagram of Xilinx FPGA. (08)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Explain the different scales of integration in microelectronics evolution. Also compare the speed/power performance of available technologies used in IC production. (10)
   b) What are the general considerations in VLSI system design? Mention the problems associated with VLSI design and discuss on conventional steps to overcome them. (11)
   c) State λ-based design rules and hence draw the stick diagram and mask layout of nMOS shift register cell. (14)

6. a) Design a basic static flipflop using nMOS technology and extend it to JK flipflop to overcome the racing condition. Explain the working principles of your design. (11)
   b) Write note on CMOS domino logic. (06)
   c) What are the advantages of clock-loading in dynamic flip-flop? Explain the working principle of clock-load dynamic shift chair. (08)
   d) What is RAM? Design an nMOS based three-transistors RAM cell and estimate its storing capability considering 1 Sq-cm chip size and 0.5 μm technology. (10)

7. a) Explain the Latch-up effects in CMOS circuit. How does the BiCMOS technology overcome Latch-up problems? (10)
   b) Illustrate dynamic CMOS logic approach to realize a 3-input NOR gate. Mention the problems associated with this logic and discuss on possible remedy measures against them. (12)
   c) What is structured design approach? Design a bus arbitration logic circuit for *n*-line bus using structured approach and explain its working principle. (13)

8. a) What are the general requirements of a shifter used in microprocessor? (07)
   b) Why is GaAs technology suitable for ultra-fast systems? (06)
   c) Mention some features of GaAs technology and Si/Ge technology. (12)
   d) What is meant by nanoelectronics? Which materials are promising for nanoelectronics devices? Explain briefly. (10)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 4th Year 1st Term Examination, 2017

Department of Electronics and Communication Engineering

ECE 4105

(Optical Fiber Communications)

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) b-V curves for planar waveguides
iv) b-V curves for optical fiber

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) What is optical fiber? Classify optical fiber according to the mode of propagation. Mention the advantages and disadvantages of multi-mode fiber relative to single mode fiber. (08)

b) A step index fiber is designed with a solid acceptance angle of 0.115 radians and a relative refractive index difference, Δ of 0.5% for long distance transmission. (12)
   i) Why should Δ be so small?
   ii) Find the critical angle for internal reflection.
   iii) Estimate the NA of the fiber.
   iv) Estimate the speed of light in the fiber core.

c) What should be the limit of propagation constant (β) for a guided mode? (04)

d) Skew rays are accepted into a large core diameter step index fiber in air at a maximum axial angle of 42^0. Within the fiber, the change direction by 90^0 at each reflection. Determine the acceptance angle for meridional rays for the fiber in air. (11)

2. a) In the case of parallel polarization, the co-efficient of reflection can be expressed as: $r_p = \frac{n_1 cos\varphi_i - n_2 cos\varphi_t}{n_1 cos\varphi_i + n_2 cos\varphi_t}$ where n_1 and n_2 are the refractive indices of two medias, φ_i and φ_t are the angles of incidence and refraction, respectively: (13)
   i) Briefly explain $r_p = e^{j2\varphi_p}$ in TIR.
   ii) Prove $\varphi_p = tan^{-1}\left[\left({}^{n_1}/_{n_2}\right)^2 \frac{\sqrt{sin^2\varphi_i - \left({}^{n_2}/_{n_1}\right)^2}}{cos\varphi_i}\right]$.

b) Briefly discuss, with the aid of suitable diagrams, the concept of the evanescent field and Goos-Haenchen shift in optical fiber. Describe the effect of these phenomena on the propagation of light in fiber. (08)

c) A symmetric planar waveguide is consist of a polymer core layer of thickness d=1.20 μm between the silica substrate and cover. At 1.33 μm optical wavelength n_1=1.75 for the polymer core, and n_2=1.50 for the silica substrate and cover, (09)
   i) How many guided modes are supported by this waveguide? Sketch the field distribution of them.
   ii) Find the propagation constant for the fundamental TE mode of this waveguide.
   iii) Find the wavelength range, ignoring the dispersion of waveguide material, within which it is single mode.

d) Explain clearly the mechanism of four sources of dispersion in optical fiber link. (05)

3. a) Explain the zig-zag wave theory of light propagating through an optical fiber. Show that the waveguide dispersion parameter $D_W = -\frac{n_1 - n_2}{\lambda c} V \frac{d^2(bV)}{dV^2}$, where the symbols have their usual meanings. (12)

b) What are dispersion compensation fibers (DCF) and dispersion shifted fiber (DSF)? Explain how to shift dispersion in such fiber during fabrication. (10)

c) A multimode step index fiber has a relative refractive index difference of 1% and a (13)

core refractive index of 1.46. The maximum optical bandwidth that may be obtained with a particular source on a 4.50 Km link is 3.10 MHz.

i) Determine the rms pulse broadening per kilometer resulting from chromatic dispersion.

ii) Assuming waveguide dispersion may be ignored, estimate the rms spectral width of the source used, if the material dispersion parameter for the fiber at the operating wavelength is 90 $ps.nm^{-1}.Km^{-1}$.

4. a) What is non-linear effect in optical fiber? Briefly explain the non-linear phenomena of SRS and SPM in optical fiber communication. (10)

b) Explain what is meant by self-phase modulation. Identify and discuss a major application area for this non-linear phenomenon. (08)

c) Discuss the power budget and dispersion budget analysis for the fiber link design. (08)

d) A step-index silica fiber has a core diameter of 10 μm, and a relative index difference of 0.5%. If the operating wavelength is 1.30 μm, list the types of modes that are allowed to propagate and sketch their electric field distributions. (09)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Show that the threshold gain per unit length can be expressed by $g_{th} = \bar{\alpha} + {}^{1}/_{2L}\, ln\, {}^{1}/_{r_1 r_2}$, where the symbols have their usual meanings. (08)

b) Define and explain briefly the internal quantum efficiency of an LED. What do you mean by DFB-LD? (07)

c) Calculate the ratio of the stimulated emission rate to the spontaneous emission rate for an incandescent lamp operating at a temperature of 1000K. It may be assumed that the average operating wavelength is 0.5 μm. (10)

d) The minority carrier recombination lifetime for an LED is 5 *ns*. When a constant d.c. drive current is applied to the device the optical output power is 300 μW. Determine the optical output power when the device is modulated with an rms drive current corresponding to the d.c. drive current at frequency of 100 MHz. Also determine the 3 dB optical bandwidth for the device. (10)

6. a) Briefly explain the operation of Electro Absorption modulator. Also discuss its advantages and disadvantages in compare with Mach-Zehnder Modulator (MZM). (10)

b) How Mach-Zehnder Modulator (MZM) works as a pulse curver to produce different duty cycles of Return-to-Zero (RZ) signals? (10)

c) Draw the block diagram of the front end of an optical receiver showing the various sources of noise. (06)

d) Deduce the condition of Bragg diffraction for designing the distributed feedback laser. (09)

7. a) Prove that the error probability in optical receiver for Gaussian noise can be expressed by; $P_e = Q\left(\frac{S_1 - S_0}{\sigma_1 + \sigma_0}\right)$, where the symbols have their usual meanings. (10)

b) Given that the following measurements were taken for an APD, calculate the multiplication factor for the device; received optical power at 1.35 μm=0.2 μW, corresponding output photo-current =4.90 μA (with avalanche gain), quantum efficiency at 1.35 μm=40%. (10)

c) Differentiate between Homodyne and Heterodyne coherent detection schemes. (06)

d) Evaluate the sensitivity of APD receiver for target BER of 10^{-9}, wavelength of 1.55 μm and an OOK modulation with 1 Gb/s data rate. Note that the InGaAs APD receiver with 50% quantum efficiency, APD gain M=10 and noise excess factor F_a=10. (09)

8. a) Draw the blocks for coherent optical receiver with the expressions of optical signals in receiver input, local oscillator and detector outputs. Also mention why this receiver shows improved sensitivity compare to direct detection optical receiver. (08)

b) Describe the modulation phase shift method for measuring the chromatic dispersion with necessary diagrams. (09)

c) A four-port multimode fiber FBT coupler has 60 μW optical power launched into port 1. The measured output powers at port 2, 3, and 4 are 0.004, 26.0, and 27.50 μW, respectively. Determine the excess loss, the insertion losses between the input and output ports, the crosstalk and the split ratio for the device. (11)

d) A single mode fiber has the following parameters: (07)

Normalized frequency (υ)=2.40,
Core refractive index (n_1)=1.75,
Core diameter (2a)=8μm,
Numerical aperture (NA)= 0.10.

Estimate the total insertion loss of a fiber joint with a lateral mismatch of 1 μm and an angular misalignment of 1^0.

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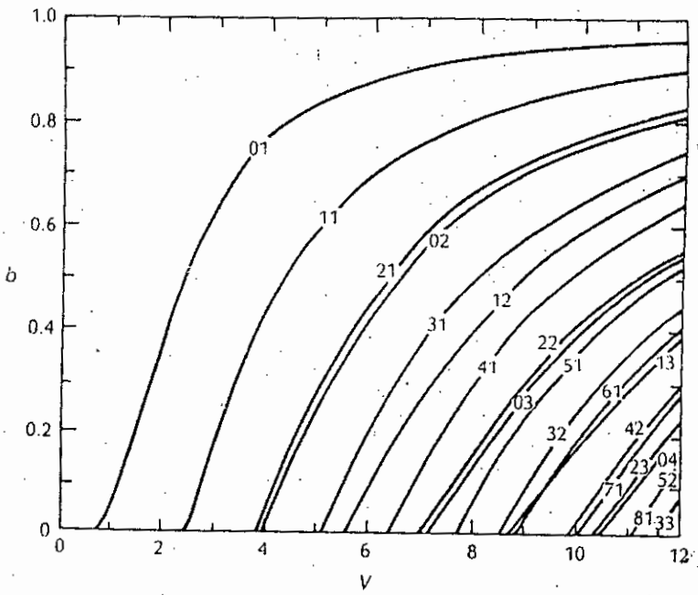

Fig. b-V curves for an optical fiber

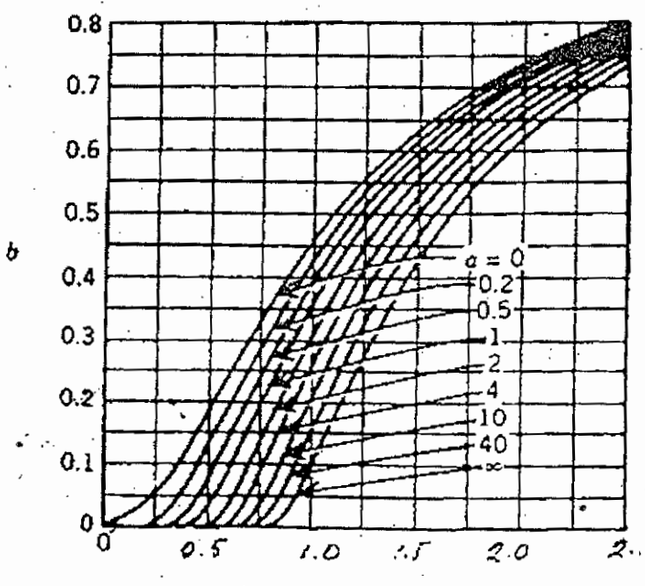

Fig. b-V curves for TE mode of planar waveguide

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 4th Year 1st Term Examination, 2017

Department of Electronics and Communication Engineering

ECE 4103

(Wireless Communications)

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Table (for Mathematics) may be supplied if necessary

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) What are the purposes of scrambling and framing in digital mobile communication system? (07)
   b) Construct the model of a basic cellular system and explain every element of the model. (07)
   c) What do you mean by frequency management and channel assignment in mobile communication system? (07)
   d) Give the flowchart for diagnostic and problem solving procedure for system configuration in mobile communication system. (07)
   e) Classify different logical channels used in cellular communications. (07)

2. a) Distinguish between co-channel interference and adjacent channel interference. How does co-channel interference relate with system capacity? (10)
   b) What are the engineer's role for planning and designing a cellular system? (06)
   c) How many users can be supported for 0.5% blocking probability for the following number of trunked in a blocked calls cleared system (i) 1, (ii) 5, and (iii) 10? Assume each user generates 0.10 Erlangs of traffic. (09)
   d) A spectrum of 30 MHz is allocated to a wireless FDD cellular system which uses two 25KHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (a) thirteen cell reuse, and (b) seventeen cell reuse. If 1MHz of the allocated spectrum is dedicated to control channels, determine an equitable distribution of control channels and voice channels in each cell for each of the systems. (10)

3. a) What do you mean by cell splitting and cell sectoring? (06)
   b) Prove that frequency reuse ratio (q) in cellular system is equal to $\sqrt{3N}$, where the symbols have their usual meanings. (09)
   c) Dr. Mcgill wants to call Dr. Simone from Khulna to Bangkok, Thailand. Establish the connection using GSM protocol. (10)
   d) Let us consider a cellular system with 395 total allocated voice channel frequencies. If the traffic is uniform with an average call holding time of 120 seconds and the call blocking during the system busy hour is 2%, calculate: (10)
      i) The number of calls per cell site per hour.
      ii) The mean S/I ratio for cell reuse factors equal to 4, 7, and 12. Assume omnidirectional antennas with six interferers in the first tier and a slope for the path loss of 40 dB/decade (r = 4).

4. a) Write down the functions of PSTN and MSC. (08)
   b) Draw the block diagram of a pager. What are the challenges of using paging service? (10)
   c) Define protocol architecture. Draw the single line diagram of IEEE 802.16 system reference points. (10)
   d) Write down the differences between a radio station and a mobile station. (07)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) What do you mean by fading? What are the factors that influence fading? (10)
   b) Develop an impulse response model of a multipath channel. (10)
   c) "Uplink frequencies in mobile system are always lower band of frequency" – Justify the statement. (06)
   d) What do you mean by duplex distance and carrier separation? (09)

6. a) Deduce the expressions for Rayleigh and Rician fading distributions. (12)
   b) Why FH-SS is used? Give the block diagram of transmitter and receiver of FH-SS system. (07)
   c) Describe various types of transmission problems that may occur during the transmission of a radio signal. (09)
   d) What is Ciphering and how the equalization should be done? (07)

7. a) Why queuing of handoff is necessary? Develop the theory of queuing the handoff calls but not the originating calls. (10)
   b) Why non-linear equalization is used? Explain the operation of a maximum likelihood sequence estimator with an adaptive matched filter. (12)
   c) What are the practical space diversity considerations? Explain maximal ratio combining and equal gain combining. (13)

8. a) Draw the block diagram of IS-95 forward link transmission and also show the forward link channel parameters. (13)
   b) What is opportunistic spectrum access? How can you improve spectrum utilization factor? (10)
   c) What is PN sequence? Distinguish between mobile assisted handoff and cell-site handoff. (12)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 4th Year 1st Term Examination, 2017

Department of Electronics and Communication Engineering

ECE-4109

(Computer Networks)

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) "IP is a connectionless, best effort delivery and media independent protocol"-justify the statement. (08)
   b) Briefly explain TCP/IP model and relate TCP/IP model with OSI model. (08)
   c) How does DHCP work? What is the purpose of it? Explain with proper network topology. (12)
   d) What is class full IP addressing? What are the IP classes? (07)

2. a) What are the query messages of ICMP protocol? Discuss the transition strategies from IPv4 to IPv6 address scheme. (11)
   b) Determine the header check sum from the following information: i) packet type-IPv4; ii) HLEN=5; iii) Type of service =2; iv) Total length=28; v) Identity =10; vi) Flag=0; vii) TTL=4; viii) Offset=0, ix) Protocol=TCP; x) Source IP=10.12.14.5; xi) Destination IP=12.6.7.9. (10)
   c) "PAT is more economic that NAT"-Justify the statement. (06)
   d) What is the difference between metric and administrative distance? What are the desirable properties of a router? (08)

3. a) Write the matrices for i) EIGRP; ii) OSPF and iii) RIP routing protocols. (06)
   b) What is the difference between routing and forwarding? (06)
   c) How do the nodes connected in Fig. 3(c) converge their routing information according to distance vector routing algorithm (The number in each link denotes link cost). (10)

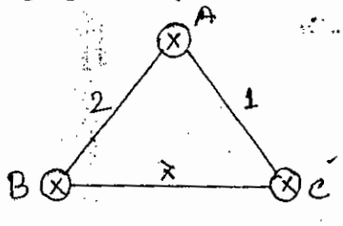

Fig. for 3(c)

   d) Let you are the network administrator of KUET router shown in Fig. 3(d); having 3 networks and a p2p connection to ISP. The required no. of interface that to be supported for those 3 networks are also shown. Let you are assigned an address block 180.211.192.0/22. Provide network address for the networks. (13)

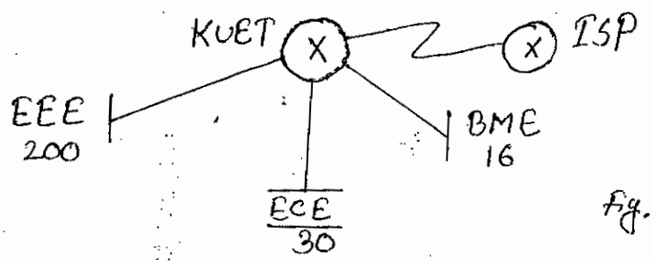

Fig. for 3(d)

4. a) What is the man-in-the middle attack? (06)
   b) Using RSA algorithm encrypt the message "10" and decrypt the cipher text to retrieve the original message. Choose p=11 and q=13 to find the public key and private key. (10)
   c) Why should a node have a MAC address in addition to an IP address? (08)
   d) How do packet sniffing and IP spoofing create tweats to Internet security? What are the counter measures of them? (11)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) What are the components of computer networks? What are the edge and core of computer networks? (08)
   b) What are the benefits of packet switching over circuit switching? (08)
   c) Classify LAN topologies. "Star topology with a hub is physically star but logically bus"- justify the statement. (10)
   d) "The protocol for web application HTTP is called stateless"-why? With stateless property how web servers recognize clients? (09)

6. a) Differentiate between virtual circuit network and datagram network. (08)
   b) Write the importance of DNS in Internet. For DNS address resolution, explain recursive query and iterative query. (08)
   c) Differentiate between SMTP & POP3. (06)
   d) Suppose there is an institutional network where average request from the institution browsers to the origin servers are 15 per second and each request size is 100 kbit. Now, (i) what will be the total response time to satisfy the request? (ii) if the access link BW increased to 1.5 Mbps to 10 Mbps, what will be the response time? (iii) If without upgrading the access link, a web cache with hit rate 40 % is installed, what will be the response time? (13)

7. a) Explain positive and negative sides of connection oriented and reliable services. (09)
   b) Design a reliable data transfer protocol having bit error using finite state machine. (10)
   c) Show the pictorial diagram of TCP's connection establishment and connection termination process. (10)
   d) Why an application developer might choose to run an application over UDP rather than TCP? (06)

8. a) Explain the necessity of transport layer address as you have addresses in network layer. (09)
   b) Describe the relationship between sequence size and window size in Go-Back-N ARQ. (12)
   c) Write the process of fast retransmission in TCP. (06)
   d) Describe how TCP flow control works. (08)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 4th Year 1st Term Examination, 2017

Department of Electronics and Communication Engineering

ECE 4105 4129

(Digital Image Processing)

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) What are the methods of image sensing and acquisition? Briefly explain the common types of sensor used for image acquisition. (10)

   b) What are the foundations for representing images in various degrees of resolution? Explain briefly. (08)

   c) What do you mean by adjacency? Briefly explain different types adjacency. (07)

   d) Consider the following arrangement of pixels given below and assume each pixel has value either 0 or 1. (10)

$$\begin{matrix} & & P_7 & P_8 \\ & P_4 & P_5 & P_6 \\ P_1 & P_2 & P_3 & \\ P & & & \end{matrix}$$

   Suppose that the adjacency of pixels valued 1(i.e. V={1}). Now mention what should be the value of each pixel if the shortest m-path between P and P_8 is defined by the path $PP_2P_4P_7P_8$?

2. a) Distinguish between global histogram processing and local histogram processing. (06)

   b) With the reference of gray level transformation curve, justify that the log transform is a special case of power transform. (09)

   c) Consider the 8-bit image given below in figure 2(c) (08)

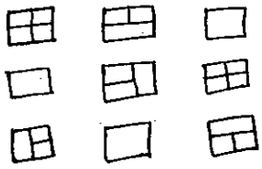

Figure 2(c)

Where the image intensity levels are defined as:-
 = 0;  = 55;  = 100;  = 155;  = 200;  = 255; now find the output image negatives.

   d) Assuming continuous intensity values, suppose that an image has the intensity pdf, (12)
$W_k(k) = \frac{(L-1)}{k+kL^2-kL} \times \frac{k^2}{(0.5L-1/2)}$ for $0 \leq k \leq$L-1 and $W_k(k) = 0$ for other values of k.
Find the transformation functionthat will produce an image whose intensity pdf is $W_m(m) = \frac{m^2}{1/3(L-1)^3}$ for $0 \leq m \leq$L-1 and $W_m(m) = 0$ for other values of m.

3. a) Define alpha-trimmed mean filter. For which conditions, the alpha-trimmed mean filter reduces to the arithmetic mean filter and it becomes a median filter? (05)

   b) "Low pass filtering in the spatial domain can be thought as local averaging operations"- *justify the statement.* (08)

   c) Figure 3(c) shows a 8-bit noisy image of size 7 × 7. Now show the result of filtering with a i) Max filter of size 3 × 3, ii) Min filter of size 3 × 3. What kind of noise is removed by this type of filtering? Write your observation based on your result you obtained. (10)

254	254	250	25	149	178	251
251	16	100	240	24	160	180
20	203	255	148	450	253	18
206	253	23	253	107	209	201
14	25	248	25	167	20	248
251	212	211	249	164	201	222
206	253	23	253	107	209	201

Figure 3(c)

d) Consider the image given in Figure 3(d). Now, find the watermarked image if the data 10110101001 is embedded to the original image using histogram shifting method. Also calculate the bit rate. (12)

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

Figure 3(d).

4. a) What do you mean by image transform? Why image transform is necessary in digital image processing? (10)

b) Find the Walsh transform basis for N=4. (08)

c) Perform the 2D DCT of the 4×4 image given in Figure 4(c). Also mention the application of DCT. (12)

100	100	100	100
100	100	100	100
100	100	100	100
100	100	100	100

Figure 4(c).

d) Mention the application of SVD in image processing. (05)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) What is meant by image compression? Show the relation between compression ratio and redundancy for different values of information carrying units. (11)

b) Explain the following terms in image processing context: i) coding redundancy; ii) fidelity criteria; iii) channel matrix; iv) P-frame. (12)

c) Consider the simple 4×8, 8-bit image shown in figure 5(c) (12)

21	21	21	95	169	243	243	243
21	21	21	95	169	243	243	243
21	21	21	95	169	243	243	243
21	21	21	95	169	243	243	243

Figure 5(c).

i) Compute the entropy of the image.
ii) Compress the image using Huffman coding.
iii) Compute the compression achieved and the effectiveness of the Huffman coding.

6. a) Write down the steps in JPEG image compression standard. (10)

b) Briefly explain the multimedia video compression standard. (12)

c) Write down the features of wavelet coding. (06)

d) Given a four symbol source {a,b,c,d} with source probabilities {0.2,0.2,0.4,0.2} arithmetically encode the sequence "abccd". (07)

7. a) Write down the significance of 1st and 2nd derivatives in edge detection. (08)
b) Briefly explain local processing and global processing via Hough transform. (12)
c) What is the thresholding and how does it play an important role in image processing applications? Explain briefly the watershed segmentations algorithm. (10)
d) Write down the steps of Canny edge detection algorithm. (05)

8. a) Derive the expression of optimal threshold used in image segmentation. (13)
b) Write short notes on Otsu's method for optimum global thresholding. (07)
c) Briefly explain the role of illumination and reflectance in image segmentation. (08)
d) How region splitting and merging can be used for image segmentation? (07)