KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 2nd Term Examination, 2015
Department of Electronics and Communication Engineering
ECE 3201
(Information Theory)

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) Define random process. The five symbols *A, B, C, D, E* occur with the probability 1/2, 1/4, 1/8, 1/16, 1/16 respectively. Compute, the information in four symbol message *x=CBAE*, when the symbols are statistically independent. (10)
   b) Define information and rate of entropy. (08)
   c) What are the basic properties of entropy? (08)
   d) Illustrate Bernoulli process and from there find the entropy. (09)

2. a) State and explain Jensen's inequality. (07)
   b) Given any two probability measures P and M on a common finite alphabet probability space, then prove that $D(P\|M) \geq 0$ with equality if and only if $P=M$. (13)
   c) State and prove Shannon's channel capacity theorem for white Gaussian noise. (15)

3. a) Explain how the output is optimum for the impulse response of a matched filter. (15)
   b) A television picture may be considered as composes of approximately 3×10^6 small picture elements. Each of these elements can assume 10 distinguishable brightness levels (such as black & shades of gray) for proper contrast. Let, for any picture element, the 10 brightness levels are equally likely to occur. There are 40 picture frames being transmitted per second. It is also given that for a satisfactory reproduction of the picture a signal to noise ratio of 1000 (30 dB) is required. Calculate the bandwidth required to transmit the video signal. (20)

4. a) "Exchange of bandwidth for signal to noise ratio is possible"- justify the statement. (15)
   b) Show that the capacity of band limited Gaussian channel with noise spectral density $N_0/2$ Watts/Hz and P Watts is $C=W\log(1+P/N_0W)$, where W is the band limit of the channel. (10)
   c) "The greater the uncertainty of a message the more of information it carries"- justify the statement with suitable example. (10)

SECTION B

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

5. a) Define the following terms: (12)
i) Leaf entropy, ii) Path length lemma, iii) Branching entropy.

b) Prove that in any tree with probabilities it holds the following relation: (10)

$$H_{leaf} = \sum_{l=1}^{N} P_l H_l$$

Where the symbols have their usual meanings.

c) State the two basic observations to design the binary Huffman code. Design Binary Huffman code for the random message 'U' with the probabilities p_1=0.4, p_2=0.1, p_3=0.1, p_4=0.1, p_5=0.1, p_6=0.1, p_7=0.1 and also compute their performance. (13)

6. a) Show that the entropy of a proper message set H(V) for an r-ary DMS U is H(V)=H(U).E[M], where symbols have their usual meanings. Also use an example to illustrate the above entropy theorem. (12)

b) Consider a binary memory less source (BMS) with the probabilities $p(0)$=0.6 and $p(1)$=0.4. Construct a binary block code of length 3 by using Tumstall's algorithm. (12)

c) Determine the overall probability decision error for hard decision and soft decision decoding. (11)

7. a) Define the following terms: (12)
i) Compression scheme with memory, ii) Adaptive Huffman coding, iii) Recency rank calculator.

b) Construct the First and Second Elias Codes for the positive integers extend from 1 to 10. (11)

c) Consider a Binary source $U_k \in \{A, B\}$, the window size W=4, l_{max}=8, D=2. Design LZ-77 codes for the source that produces the following sequences: (12)
ABBABBABBBAABABA

8. a) Define the following terms: 10)
i) Hamming Distance, ii) Coding gain, iii) bandwidth expansion ratio.

b) "A D-ary code (C_1, ……C_X) prefix free, iff in its D-ary tree every codeword is a leaf"- justify the statement with examples. (10)

c) Consider the generator matrix G for an (n, k, d, N_d) linear block code given below: (15)

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 \end{bmatrix}$$

i) Specify the values of code parameters n, k, d, and N_d.

ii) Assume that the uncoded binary PAM system has the error probability $Q\left(\sqrt{\frac{2E_b}{N_o}}\right)$, where E_b is the energy per bit and $N_0/2$ is the noise PSD. Find the Union bound estimate for the error probability per bit Pb in term of E_b/N_0 for the above code.

iii) Compute the coding gain (in dB) for this block code at $P_b=10^{-6}$.

iv) Compute band width expansion ratio.

Note: for numerical computation, you may find some of the following useful equations:

$$Q\left(\sqrt{\frac{2E_b}{N_o}}\right) = 10^{-6} \Rightarrow \frac{E_b}{N_o} \cong 10.5\,\text{dB}, \qquad \frac{7}{3}Q\left(\sqrt{\frac{24E_b}{7N_o}}\right) = 10^{-6} \Rightarrow \frac{E_b}{N_o} \cong 8.5\,\text{dB}$$

$$\frac{1}{3}Q\left(\sqrt{\frac{24E_b}{7N_o}}\right) = 10^{-6} \Rightarrow \frac{E_b}{N_o} \cong 9.1\,\text{dB}, \qquad \frac{7}{3}Q\left(\sqrt{\frac{14E_b}{7N_o}}\right) = 10^{-6} \Rightarrow \frac{E_b}{N_o} \cong 7.5\,\text{dB}$$

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 2nd Term Examination, 2015

Department of Electronics and Communication Engineering

ECE 3203

(Digital Signal 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 is digital signal processing (DSP)? What are the advantages and disadvantages of DSP? Mention some applications of it. (15)

   b) Describe some key operations of DSP using suitable examples. (12)

   c) Describe the mechanism of human speech production with necessary block diagram. (08)

2. a) Define canonic and non-canonic structures. Also distinguish between the methods of realization namely, block diagram representation and signal flow graph for implementing digital filter transfer function. (07)

   b) A filter has transfer function: (18)

$$H(z) = \frac{5}{1+0.25z^{-2}} - \frac{4}{1-0.25z^{-2}} = \frac{1-2.25z^{-2}}{(1+0.25z^{-2})(1-0.25z^{-2})}$$

   i) Draw the canonical realization form of $H(z)$.
   ii) Draw the cascade form of $H(z)$.

   c) Draw the parallel realization form of IIR digital filter transfer function: (10)

$$H(z) = 6 - \frac{4}{1+\frac{1}{2}z^{-1}} + \frac{1}{1+2z^{-1}}$$

3. a) Write the magnitude responses of Butterworth and Chebyshev high-pass filter. What are the effects of varying order of N on magnitude responses? Explain using necessary diagrams. (10)

   b) Design a band-pass filter using the pole-zero placement method with: (15)
   i) center frequency at $\Omega_0=\pi/2$;
   ii) a bandwidth of $\Omega_{3W}=\pi/8$;
   iii) complete attenuation at $\Omega_{r1}=0$ and $\Omega_{r2}=\pi$;
   iv) and peak unit pass-band gain.

   c) Compute the convolution $y=h*x$ of the filter and the input (10)
   $h=[1,-1,1,1]$, $x=[2,0,1,2,-1,0,1,0]$
   using the overlap-add method of block convolution with length-3 input blocks.

4. a) Draw the flow chart of IIR digital filter design. (08)

   b) Design a digital Chebyshev filter to meet the constraint: (15)

$$0.8 \le |H(e^{j\omega})| \le 1 \quad ; \quad 0 \le \omega \le 0.2\pi$$

$$|H(e^{j\omega})| \le 0.2 \quad ; \quad 0.6\pi \le \omega \le \pi$$

   c) A digital filter with a 3 dB bandwidth of 0.25π is to be designed from the analog filter whose system response is (12)

$$H(S) = \frac{\Omega_c}{S+\Omega_c}$$

   Use bilinear transformation and obtain $H(z)$.

SECTION B

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

5. a) Define DFT. State the shifting property of the DFT. (08)

   b) What are the "Twiddle factors" of DFT? Show that the computational complexity of direct computation of DFT is reduced in case of radix-2 FFT from N^2 to $N\log_2(N)$. (12)

   c) Determine the DFT (8-points) for a continuous time signal, $x(t)=sin(2\pi ft)$ with f=50 Hz, using DIT-FFT algorithm. (15)

6. a) What is FIR and IIR filter? What are the advantages of FIR filter and IIR filter? (08)

   b) What is "Gibb's phenomenon"? Which technique can be applied to reduce the undesirable effect from "Gibb's phenomenon"? Explain with necessary diagram. (10)

   c) A high-pass has the desired response as $H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & \left|\frac{\pi}{2}\right| \le \omega \le |\pi| \\ 0, & 0 < \omega < \left|\frac{\pi}{2}\right| \end{cases}$ (11)

   Determine the filter coefficient $h(n)$ for M=7, using Type-1 frequency sampling technique.

   d) Find the N-point DFT for $x(n)=a^n$ for $0 < a < 1$. (06)

7. a) What are the necessary and sufficient conditions to ensure linear phase characteristics in FIR filter? (08)

   b) The desired response of a low pass filter is (13)

$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & -\frac{3\pi}{4} \le \omega \le \frac{3\pi}{4} \\ 0, & \frac{3\pi}{4} < |\omega| \le \pi \end{cases}$$

   Determine $H(e^{j\omega})$ for M=7 using a Hamming window.

   c) What are the design specifications of a band-pass filter using Kaiser winder? (08)

   d) Define: i) Frequency resolution and ii) Variability. (06)

8. a) Why energy spectral density cannot be used for spectral analysis in case of random signals? Derive the techniques of spectral analysis in case of a stationary random variable. (07)

   b) Compute the auto-correlation and power spectral density for $x(t)=K\cos(2\pi f_c t+\varphi)$. (09)

   c) Explain AR, MA, and ARMA models. (13)

   d) Suppose we have N=1000 samples from a sample sequence of a random process. Determine the frequency resolution of Welch (50% overlap) and Blackman-Tuckey methods for a quality factor of Q=10. (06)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 2nd Term Examination, 2015
Department of Electronics and Communication Engineering
ECE 3205
(Digital 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.

SECTION A

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

1. a) Define Baseband, Band-pass and Band limited signal. (06)

   b) State sampling theorem. What are the practical difficulties that you may face in sampling process of a baseband signal and how can these be minimized? (10)

   c) Why and how does the channel bandwidth limit the data rate? Explain clearly. (09)

   d) A band limited signal is expressed as $10+5\cos\pi 10\times 10^6 t$. (10)

      i) Sketch the spectrum of the signal.

      ii) What will be the required channel bandwidth to transmit this signal considering noise free?

      iii) Estimate thermal noise level of this channel when operated at 30°C.

      iv) Assuming the channel is thermal noise limited, calculate the capacity of the channel carrying 1 μW of power.

2. a) Explain the various quantization noises in PCM process. Is it possible to reduce such noises without increasing the number of bit? Explain the required process for this. (10)

   b) What are the major sources of noise in a PCM system? Derive the expression for the output signal to quantization noise ratio in PCM. (10)

   c) Explain the approach to signal prediction in differential PCM (DPCM). (09)

   d) A television channel has a bandwidth of 4.5 MHz. The signal is sampled, quantized and binary coded to obtain a PCM signal. If the signal is to be sampled at a rate 20% above the Nyquist rate and quantized into 1024 levels, determine the binary pulse rate (bps) of the encoded signal and the minimum bandwidth required to transmit the signal. (06)

3. a) "Delta modulation is the one bit version of DPCM"- Justify the statement. (07)

   b) Briefly describe the principle of ADM technique. What is CVSD? (08)

   c) What is an eye pattern? From the eye pattern, how the sensitivity of the system can be determined? (10)

   d) A DM system is tested with a 10 KHz sinusoidal signal, 1 V peak to peak, at the input. The signal is sampled at 10 times the Nyquist rate. (10)

      i) What is the step size required to prevent slope overload and to minimize granular noise?

      ii) What is the PSD of the granular noise?

      iii) If the receiver input is band limited to 200 KHz, what is the average signal to quantizing noise power ratio?

4. a) Define line coding. What is the difference between source coding and line coding? (08)

b) Mention the major advantages of Manchester and HDB3 over other codes. (08)

c) Write down the differences between synchronous and asynchronous transmission with their frame format. (08)

d) A μ-law compander is defined as $y=\pm ln(1+\mu_0|x|)/ln(1+\mu)$. Where, $|x|<1$, x is input and y is output. If the peak of the input is 10 V and one of bits available of quantization are 8, the find the smallest and largest separation between levels. Consider, μ=255. (11)

SECTION B

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

5. a) Define: information rate, bit rate, and baud rate. What will happen if M increases in a M-ary ASK? Why cannot you increase M infinity? (11)

b) What is the bandwidth requirement of PSK? Why PSK is much robust than ASK? (06)

c) What are the three most predominant modulation schemes used in digital radio systems? With proper block diagram, explain PLL and FSK demodulation process. (08)

d) For a BPSK modulator with a carrier frequency of 70 MHZ and an input bit rate of 10 Mbps, determine the maximum and minimum upper and lower side frequencies, draw the output spectrum, determine the minimum Nyquist bandwidth, and calculate the baud. (10)

6. a) i) Draw the block diagram of an 8-QAM modulator. ii) Define tribit. iii) for a tribit input Q=0, I=1, and C=0, determine the output amplitude and phase for the 8-QAM transmitter considering the reference carrier as $\cos\omega_c t$. (14)

b) Suppose the input bit sequence: 010101100101, for a QPSK modulator, i) Draw the I bit, and Q bit, ii) Determine the output phase sequence of the reference carrier $\sin\omega_c t$, iii) determine the number of symbols, iv) Now, consider the reference carrier changed to $\cos\omega_c t$, draw the corresponding constellation diagram. (15)

c) i) For the DBPSK modulator, determine the output phase sequence for the following input bit sequence: 01010100110011. (06)

ii) What advantages does DBPSK have over conventional PSK, OQPSK over QPSK, and CP-FSK over FSK.

7. a) Describe the concept of spread spectrum. What are the benefits that can be achieved using spread spectrum technique? (07)

b) Consider, the input data sequences: 101100, and the spreading code corresponding to input data is 110 010 111 011 000 100. Now draw the direct sequence spread spectrum waveform using BPSK (08)

c) What are the comparisons between QPSK and MSK? Explain it by using their PSD diagram. (09)

d) For minimum shift keying (MSK) modulation scheme, show that the change in carrier phase from symbol 0 to symbol 1 is π/2 radians. What are the advantages does GMSK provide while used for GSM. (11)

8. a) Explain the comparisons among TDMA, CDMA, and OFDM techniques. (10)

b) What do you mean by optimum receiver? Show that the transfer function of the optimum receiver is the complex conjugate of the spectrum of the input signal. (11)

c) Show that, the average probability of symbol error for coherent QPSK receiver in the presence of additive white Gaussian noise is, $p_e = erfc(\sqrt{\frac{E_b}{N_0}})$, where the symbols have their usual meanings. (10)

d) Determine, i) Carrier power in dBm, ii) Noise power in dBm, iii) Noise power density in dBm, iv) Energy per bit in dBJ, v) Carrier to noise power ratio, and vi) E_b/N_0 ratio, for the following parameters:

$C=10^{-13}$ W, f_b=30 kbps, $N=0.06\times10^{-15}$ W, and B=60 kHz.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 2nd Term Examination 2015

Department of Electronics and Communication Engineering

ECE 3207

(Antenna Engineering)

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 do you mean by an Antenna in respect of IEEE? Draw the equivalent circuit of antenna in transmitting and receiving mode. (04+06)

   b) State the fundamental relation of electromagnetic radiation. Also interpret the criteria for the electromagnetic radiation. (10)

   c) Define the followings i) Radian and Steradian ii) Normalized field pattern iii) Radiating near field region (08)

   d) The radial component of the radiated power density of an infinitesimal linear dipole of length $l<<\lambda$ is given by $W_{av} = \hat{a}_r W_r = \hat{a}_r A_0 \sin^2\theta / r^2$ (w/m^2) where A_0 is the peak value of the power density, θ is the usual spherical coordinate and a_r is the radial unit vector. Determine the maximum directivity of the antenna. (07)

2. a) Derive the expression of maximum power that could be delivered to the antenna. (12)

   b) What is antenna efficiency and aperture efficiency of an antenna? (10)

   c) Drive Friss transmission line equation under general condition. (13)

3. a) With the help of Lorentz condition, deduce the expression of electric field due to the vector potential $\vec{A}$ and source $\vec{J}$. (14)

   b) State and explain Duality theorem. (09)

   c) State and explain the reciprocity and reaction theorems in case of electromagnetic theory. (12)

4. a) What are the characteristics of an infinitesimal dipole antenna? For this type antenna, show that i) radial electrical energy> radial magnetic energy. (ii) Conditions for the reactive power diminishes. (ii) $R_r = \eta(2\pi/3)(l/\lambda)^2$, where the symbols have their usual meanings. (iv) The value of R_r for $\lambda/50$ dipole antenna. (16)

   b) Show that total field=element factor x space factor and hence find the value of total E and H field of finite length dipole. (11)

   c) Draw the equivalent circuit of a loop antenna in transmitting mode. How can we increase the radiation resistance of a loop antenna? (08)

SECTION B

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

5. a) Describe parasitic array with suitable diagram. (06)
   b) What is endfire array? (04)
   c) What do you mean by tapering of array? What are the techniques available to reduce the side lobe level? (08)
   d) Justify that "array of 2 point sources with equal amplitude and opposite phase satisfy the endfire array". From the equation draw its field pattern. (10+3)
   e) Define Hertizian dipole. (04)

6. a) "Input impedance at the terminals of a folded dipole antenna is equal to the square of number of conductors." – Justify the statement. (09)
   b) How can you increase the power gain and directivity of V-antenna? (4+4)
   c) To get the maximum field intensity of Rhombic antenna, write down the factors for designing it. (08)
   d) For designing Rhombic antenna find out the value of height $h=\lambda/4\sin\beta$ meters, where the symbols have their usual meanings. (10)

7. a) What do you mean by ideal feed? Show that focal length to aperture ratio "$f/D= 0.25\cot\theta/2$" of parabolic reflector, where the symbols have their usual meanings. (3+10)
   b) Prove that internal dimension of rectangular waveguide of E-plane metal plate lens antenna $a=\lambda/2$, where the symbols have their usual meanings. (12)
   c) Calculate the voltage induced in a loop antenna of 1 m^2 of 10 turns, with its plane at 45^0 off the line of bearing of a distant station due to an incident magnetic field of strength of 10^{-7} wb/m^2 at a wavelength of 100 m. (10)

8. a) What are the modes of radiation of Helical antenna? Deduce the condition for pitch angle in order to get circular polarization of Helical antenna. (12)
   b) Show that spacing factor $\sigma=(1-\tau)/4\tan\alpha/2$ and apex angle $\alpha = 2\tan^{-1}(1-\tau/4\alpha)$ for log periodic antenna, where the symbols have their usual meanings. (15)
   c) Calculate the angular aperture for a paraboloid reflector antenna for which aperture number is (i) 0.25 and (ii) 0.50. Given that diameter of the reflector mouth is 10 m, Calculate the position of focal point with refrence to the reflector mouth in each case. (08)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 2nd Term Examination 2015

Department of Electronics and Communication Engineering

CSE 3209

(Database System)

TIME: 3 hours FULL MARKS: 210

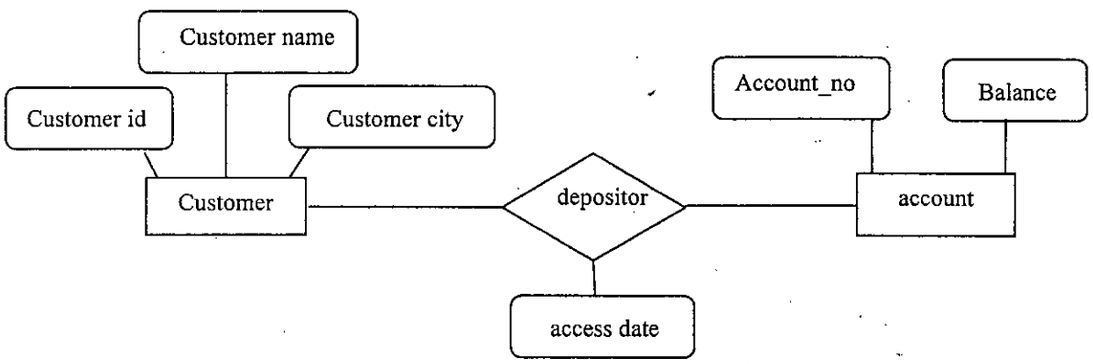
N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

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

1. a) What is DBMS? What are the advantages of DBMS (07)
   b) Write down the differences between (i) Primary key and (ii) Candidate key. (06)
   c) Describe the mapping cardinality with respect to a binary relationship. (10)
   d) A University maintains data about the following entities ; (12)
      (i) Course including course number, title, credit, references, instructor-id, domain.
      (ii) Course offering including course number, year, term, section number, timing and class room.
      (iii) Students including student-id, name and department.
      (iv) Instructor including instructor-id, name, department and title. Develop an ER diagram for the system.

2. a) Define (i) Relational database (ii) Functional dependency. (08)
   b) Suppose a relation R(A,B,C) is with the dependency (i) A → B, (ii) B→ C. Then write, what type of functional dependency exists in here. (08)
   c) Write down the differences between (i) Partial and (ii) Fully & functional dependency (09)
   d) Design a relational schema from the following ER diagram. (10)



3. a) Write all the rules of " Armstrong". (07)

b) Suppose you have the relation R(A, B, C, D, E, F, G, H) and the functional dependencies for this relation as follows ; (13)

$CH \rightarrow G$, $A \rightarrow BC$, $B \rightarrow$ **CFH,** $E \rightarrow A$ and $F \rightarrow EG$

Now, write/list all the candidate keys for the above relation and dependencies.

c) What do you mean by extraneous attributes? Explain it with an example. (08)

d) What do you mean by functional decomposition? Explain it with an example. (07)

4. a) What are the goals of database normalization? (06)

b) If a relation R(A, B, C, D, E, F, G, H) is decomposed into ; (12)

F = [(i) $AB \rightarrow C$, (ii) $B \rightarrow D$, (iii) $AC \rightarrow$ **D, (iv) BC** $\rightarrow A$ (v) $AD \rightarrow E$ and (vi) $E \rightarrow G$]

De : $R_1(AB)$, $R_2(BC)$, $R_3(ABDE)$, $R_4(EG)$ Now,

(i) Is this dependency preserving? (ii) Is this loss-less or lossy decomposition?

c) Write the differences between (i) 1NF and (ii) 2NF (06)

d) Suppose you have the relation R(W, X, Y, Z) and F= {($WX \rightarrow Y$, $Y \rightarrow X$, $Y \rightarrow Z$)} (11)
Now list which are prime attribute and which are not prime attribute.

SECTION B

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

5. a) "Datatype is a physical thing while domain is a logical thing" – Justify the statement. (05)

b) What do you mean by PL/SQL? Write the basic structure of PL/SQL block. (07)

c) Consider the following 4 tables as directed. (15)

(Assume appropriate data type for each field)

Department ((dept_id, dept_name);

Student (roll, name, dept_id(FK));

Course (course_id, course_name, , credit);

Course-taken(roll(FK), course_id(FK), year);

Now write appropriate SQL statements for the following findings:

(i) Create course table by specifying appropriate primary and foreign keys. 'Course_name' field of 'course', table must be unique and 'credit' field of 'course ' table must be less than 5.00.

(ii) Find the 'roll' and 'name' of students whose name contain the character 'a'

(iii) Find the 'name' of the students of 'ECE' department.

(iv) Find the total number of students of 'ECE' department.

(v) Find the name of students who took 'database systems' course.

d) What do you mean by view? What are the advantages of view? (08)

6. a) What do you mean by domain constrains in a relation? Explain it with an example (12)

b) What does 'ACID' property of DBMS stand for? Describe in brief. (08)

c) Consider the following table : (15)

Roll	Subject	Marks	Grade
1	S1	80	
1	S2	75	
2	S1	67	
2	S2	85	
1	S3	77	

Write PL/SQL program for the following questions ; (i) Create a trigger that calculates the grade from 'mark' field and insert grade into the 'grade' field of the table 'student' (ii) Write a PL/SQL Anonymous block to calculate the average mark of the student whose role is 1.

7 a) Define transaction for a database. Draw the state transition diagram of transaction. (07)

b) What is 2-phase locking ? Refer to the following figure, which concurrency problem does it reflect? How can you overcome the problem by using 2-phase locking (2PL)? (14)

Time	T1	T2	X
t1		begin-transaction	100
t2	begin-transaction	read(x)	100
t3	read(x)	x=x+100	100
t4	x=x-100	write (x)	200
t5	write (x)	commit	0
t6	commit		0

c) What are the objectives of serializability? (06)

d) How does precedence graph determine whether two concurrent transactions are serializable or not? Draw the precedence graph from the following example. (08)

T1	T2
read (A) A=A-100 write (A)	
	read(A) A=A+50 write (A) read(B) B=B+100 Write B
read(B) B=B-100 write (B)	

8 a) Why is indexing necessary in DBMS? Differentiate between dense index and sparse index. (07)

b) What are the advantages of B^+ tree index files? Construct a B^+ tree for the following values where the value of n is 4. Show each step of construction {7,4, 1, 6, 2,11,8, 5} (15)

c) What is deadlock? When does it occur? (07)

d) Write the three general techniques for handling deadlock. Briefly explain 'Wait-die' and 'wound-die' policy to prevent deadlock in transaction. (06)