KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 2nd Term Examination 2017

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) Why the study of information theory is necessary for communication engineer?

b) What are the key technical properties of information? (06)

c) Illustrate the "Shannon Paradigm" model to transmit a message from transmitting and to receiving end. (06)

d) Consider a Gaussian noisy channel of fig 1(d). Here, N is the Gaussian noise with zero mean and variance σ_N^2, Z and Y are the transmitted and received signal, respectively. Z is the zero mean Gaussian variable with variance σ_Z^2. Y and N are statistically independent. Assume that channel bandwidth is B. Find the mutual information between Y and Z. Also find the channel capacity. (10+05)

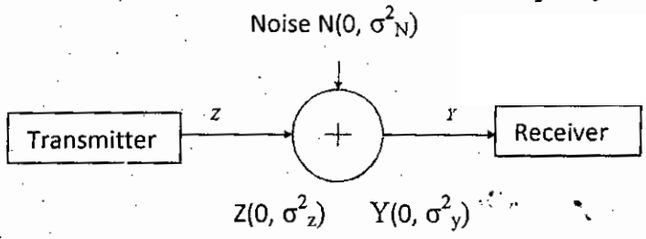

Figure 1(d)

2. a) Prove that the mutual information $I(X;Y)$ is the reduction in the uncertainty of X due to the knowledge of Y. (13)

b) Two binary symmetric channels are connected in cascade as shown in fig 2(b). Find the overall channel capacity of the cascade connection, assuming that both channels have the same transition probability. (10)

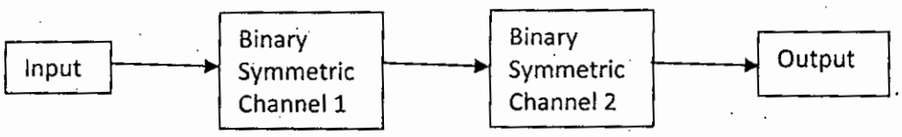

Figure 2(b)

c) Consider the Markov chain shown in fig. 2(c). (12)

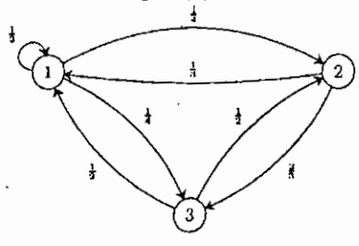

Figure 2(c)

(i) Is this chain irreducible?
(ii) IS this chain aperiodic?
(iii) Find the stationary distribution for this chain.

3. a) How can you optimize power allocation for parallel Gaussian channels? Interpret the result from the communication engineering point of view. (08+07)

b) Why Blahut-Arimoto algorithm is used in the communication system? Explain it with the flow diagram. (03+05)

c) Consider a Gaussian noise channel of power constraint P, where the signal takes two different paths and the received noisy signals are added together at the antenna as shown in fig 3(c). (12)

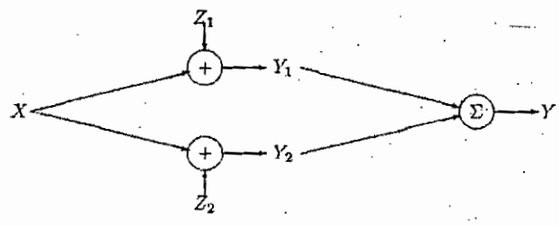

Figure 3(c)

(i) Find the capacity of this channel if Z_1 and Z_2 are jointly normal with covariance matrix $K_2 = \begin{bmatrix} \sigma^2 & \rho\sigma^2 \\ \rho\sigma^2 & \sigma^2 \end{bmatrix}$.

(ii) What is the capacity for $\rho = 0$, $\rho = 1$, $\rho = -1$.

4. a) Find the channel capacity of Gaussian Multiple access channel with m users. (12)

b) Prove that the outlet signal-to-noise power ratio increases exponentially with the bandwidth B for an ideal communication system. (08)

c) Why the channel side information is essential to view at the receiver? Explain in brief. (07)

d) Calculate the bandwidth of the picture (video) signal in a television. The following are the available data: (08)

(i) Number of distinguishable brightness level=10;
(ii) The number of elements per picture frame =300,000;
(iii)Picture frames transmitted per second=30 and
(iv)S/N required =30dB.

SECTION B

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

5. a) A binary tree is shown in fig 5(a). Compute the average depth of the leaves. Also prove that the average depth is equal to the sum of the probabilities of all nodes including the root. (10

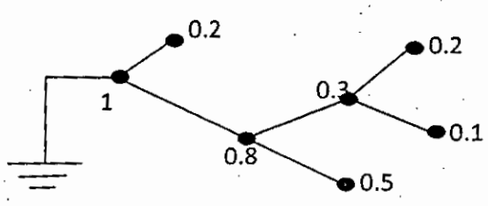

Figure 5(a)

b) What are the key differences between channel and source coding? (07)

c) "A Shannon type code achieves the ultimate lower bound by less than 1"-Justify the statement. (06)

d) Construct the binary Fano code for the random message U with symbols having probabilities: (12)
P_1=0.35, P_2=0.3, P_3=0.15 and P_4=0.05, P_5=0.05, P_6=0.05, P_7=0.05. Also compute its performance.

6. a) Consider a binary memoryless source (BMS), i.e r=2, with the following PMF: (12)

$$P_U(u) = \begin{cases} 0.4, & u = 1 \\ 0.6, & u = 0 \end{cases}.$$

Moreover, we would like to have a message set with n=5 messages. Construct the Tunstall message set corresponding to that BMS.

b) Describe the blocks that are necessary in a coding scheme for an information source. Define Block-to variable length and variable length-to-Block coding of a DMS. (10)

c) Consider the four codes listed below: (13)

Symbol	Code I	Code II	Code III	Code IV
S_0	0	0	0	00
S_1	10	01	01	01
S_2	110	001	011	10
S_3	1110	0010	110	110
S_4	1111	0011	111	111

(i) Two of these four codes are prefix codes. Identify them and construct their individual decision trees.

(ii) Apply the Kraft-Mcmillan inequality to codes I, II, III and IV. Discuss your results in light of those obtained in part (i).

7. a) Define the following terms: (i) Compression scheme with memory (ii) Adaptive Huffman coding and (iii) Recency rank calculator. (09)

b) Assume a binary source (r=2) and a parser producing block messages of length M=2. Then we have 2^2=4 possible messages {00. 01, 10, 11} at the input of the recency rank calculator. Suppose that the sequence of past messages before time K is: (13)

$$---|V_{K-4}|V_{K-3}|V_{K-2}|V_{K-1}|Now = ---|11|00|11|10|01|11|01|01|Now.$$

Compute the recency rank list in the tabular form. Also express the rank values in second Elias code.

c) For a binary linear block code with generator matrix (13)

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

Compute all possible code words. Also, compute the minimum Hamming weight and the number of code words that maintain the minimum Hamming weight.

8. a) A binary linear convolutional code has the following parameters: (13)

$$n = 3,\ k = 1,\ K = 3 \text{ and } G = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$$

Determine the encoded bits if the information bits are : 110101.

b) For the following state transition diagram as shown in fig 8(b), write down the state transition equations. Also, determine the link weight D^W. (12)

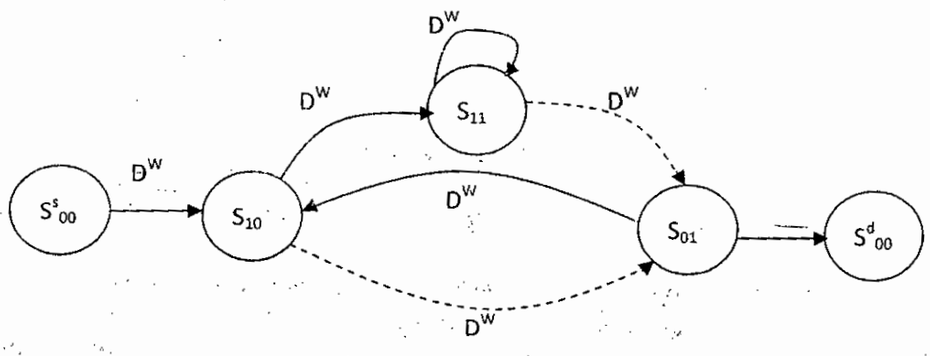

Figure 8(b)

c) Consider the following binary sequence (10)

1110100110001011010 0----

Use the Lempel-Ziv algorithm to encode this sequence. Assume that the binary symbols 0 and 1 are already in the code book.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 2nd Term Examination, 2017

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) Define DFT. State the shifting properties of DFT. (06)
   b) What is meant by correlation? Determine the circular correlation values of the two sequences, $x_1(n) = \{1, 2, 3, 4\}$ & $x_2(n) = \{4, 3, 2, 1\}$. (08)
   c) Define DTFT. State the relationship between DFT and Z-transform. (08)
   d) Derive the DFT of the sample data sequence $x(n) = \{1, 2, 3\}$ and compute the corresponding amplitude and phase spectrums. (13)

2. a) What properties of the phase factor (W_N) are exploited in FFT to reduce the computations? Calculate the number of complex multiplications and complex additions associated in direct DFT and in FFT algorithm for 128 point signal. (06)
   b) Given $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$. Find $X(k)$ using DIT-FFT algorithm. (10)
   c) What is a linear phase filter? What conditions are to be satisfied for any system to have linear phase? (07)
   d) A low-pass filter has the desired response as given: (12)

$$H_d(e^{j\omega}) = \begin{cases} e^{-j8\omega}; & 0 \le \omega \le \pi/2 \\ 0; & \pi/2 < |\omega| \le \pi \end{cases}$$

   Using the frequency sampling technique (Type-I) determine the filter coefficients. The length of the filter being $M = 9$.

3. a) What is window technique? Describe with necessary diagram. Show the comparisons between different kind of window models. (10)
   b) What is equiripple filter? Which method is applied for designing equiripple filter? Explain in brief. (09)
   c) State the Alternation theorem & draw the flowchart of Remez exchange algorithm for optimal filters. (07)
   d) Design an FIR digital filter to approximate an ideal low-pass filter with passband gain of unity, cut-off frequency of 850 Hz and working at a sampling frequency of $f_s = 5000$ Hz. The length of the impulse response is $N = 5$, use a Hanning window. (09)

4. a) Explain the design procedure of a High-pass FIR filter using Kaiser window technique with necessary design equations. (10)
   b) What are quality factor and variability of any estimator? Analyze the consistency and quality of Bartlett and Welch power spectrum estimation method. (12)
   c) Suppose we have $N = 1000$ samples from a sample sequence of a random process. Determine the frequency resolution of Welch (50% overlap) method and Blackman – Tuckey method. (06)
   d) What is meant by parametric power spectrum estimation? Differentiate between AR, MA, & ARMA methods. (07)

SECTION B

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

5. a) What is IIR digital filter? Show the design flow of IIR digital filter. (06)

   b) "The physical realizable and stable IIR filter cannot have a linear phase" – justify the statement. (06)

   c) Convert the analog band-pass filter with system function: (12)

$$H_a(s) = \frac{1}{(s+0.1)^2 + 9}$$

   into a digital IIR filter by use of (*i*) the backward difference for the derivative; and (*ii*) impulse z-transform.

   d) Design a single-pole low pass digital filter with a 3 dB bandwidth of 0.2π, using the bilinear transformation applied to the analog filter: (11)

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

   where, Ω_c is the 3 dB bandwidth of the analog filter.

6. a) Describe elliptic filters in brief. (06)

   b) What is Chebyshev filter? Discuss on its magnitude and phase response using necessary diagrams. (07)

   c) Compare the scale factors using L_1, L_2, and L_a, methods for the filter with following transfer function, assuming cascade realization with second order sections: (12)

$$H(z) = H_1(z)H_2(z)$$

$$\text{where, } H_1(z) = \frac{1 + 0.2189z^{-1} + z^{-2}}{1 - 0.0127z^{-1} + 0.9443z^{-3}}$$

$$H_2(z) = \frac{1 - 0.5291z^{-1} + z^{-2}}{1 - 0.1731z^{-1} + 0.7252z^{-2}}$$

   d) Design digital band-stop filter using pole-zero placement method with the following parameters: (10)

Center frequency $\Omega_0 = \pi/10$ radians (complete attenuation)

Band-stop width $\Omega_w = 2\Omega_c = \pi/20$ radians

7. a) Define DWT & CWT. Also write the procedural steps to compute CWT. (08)

   b) Discuss the Mallat filter scheme of wavelet signal processing. (12)

   c) Obtain the direct form-I, direct form-II, cascade, and parallel structures for the following system: (15)

$$y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}y(n-2) + x(n) + \frac{1}{3}x(n-1)$$

8. a) Distinguish between a DSP processor and a microprocessor. What are the special features of a DSP processor must possess? Explain them in brief. (12)

   b) Draw and explain the flow chart of the FIR filter for implementation in DSP processor. (12)

   c) Describe the architecture of a hardware IIR digital filter using suitable diagram. (11)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 2nd Term Examination 2017

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) Draw the appropriate block diagram for basic digital communication system and explain the sources, transmitters, transmission channels and receivers for digital communications. (10)
   b) Describe briefly the most significant impairments in digital communication systems. (12)
   c) Why and how does the channel bandwidth limit the data rate? Explain clearly. (06)
   d) Given a channel with an intended capacity of 100 Mbps, the bandwidth of the channel is 20 MHz. Assuming white thermal noise, what signal power is required to achieve this capacity at 30^0. (07)

2. a) State the sampling theorem and show that a band-limited signal of finite energy with highest frequency W Hz, may be completely recovered from samples of the signal at a rate of 2W samples per second. (09)
   b) Show that the signal to quantization noise ratio increases approximately 6 dB for every bit added to the PCM word length. (09)
   c) What is eye pattern? What are the useful informations an eye pattern provide? Explain. (07)
   d) A signal band-limited to 1 MHz is sampled at a rate 50% higher than the Nyquist rate and quantized into 256 levels using a μ-law quantizer with $\mu=255$. (10)
      (i) Determine the signal to quantization noise ratio (SNR).
      (ii) The SNR found in part (i) was unsatisfactory. It must be increased at least by 10dB. Would you be able to obtain the desired SNR without increasing the transmission bandwidth if it was found that a sampling rate 20% above the Nyquist rate is adequate? If so, explain how.
      (iii) What is the maximum SNR that can be realized in this way?

3. a) Briefly illustrate the DPCM process with the aid of block diagram. Also explain the technique of signal prediction in this process. (10)
   b) What are the disadvantages of DM techniques? Briefly describe the principle of ADM technique. (09)
   c) Compare the performance of DM over PCM. (06)
   d) In a signal-integration DM system, the voice signal is sampled at a rate of 64 KHz. The maximum signal amplitude $A_{max}=1$. (10)
      (i) Determine the minimum value of the step size to avoid slope overload.
      (ii) Determine the granular noise power if the voice signal bandwidth is 3.5 KHz.
      (iii)Assuming the voice signal is sinusoidal, determine the SNR and
      (iv)Determine the minimum transmission bandwidth.

4. a) What is line coding? What are the properties of a line coding? (06)
   b) Explain the North American and CCITT recommended digital TDM hierarchy. (10)
   c) Are NRZ codes capable of self-synchronization? Why? Mention the major advantages of HDB3 code over other codes. (10)

d) What are the importances of frame synchronization at TDM system? Explain the two-channel bit-interleaved TDM with pulse stuffing technique. (09)

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 to infinity? (10)

b) Why Continuous Phase Frequency Shift Keying (CPFSK) is necessary? Explain mathematically how phase change of 90^0 is maintained in Minimum Shift Keying (MSK) for each bit transition? What modification of MSK leads to Gaussian-MSK (GMSK)? (13)

c) With suitable block diagram explain the bandwidth considerations of Quadrature Phase Shift Keying (QPSK). Comparing with the bandwidth requirement of BPSK, explain the advantages of M-ary Encoding in terms of bandwidth requirement. (12)

6. a) Suppose, the input bit sequence: 110110010101, for a 8-PSK modulator. (i) Draw the I bit, Q bit and C bit, (ii) Determine the number of distinct symbols generated, (iii) For each symbol generated mathematically calculate the amplitude and phase of the reference carrier $sin\omega_c t$, and (iv) Draw the corresponding constellation diagram. (11)

b) Describe how Quadrature Amplitude Modulation (QAM) reduces the likelihood of errors? With appropriate block diagram, explain the operations of 16-QAM transmitter. (10)

c) For a QPSK modulator with an input data rate (f_b) equal to 20 Mbps and a carrier frequency 75 MHz, determine the minimum double-sided Nyquist bandwidth (f_N) and the baud. Also, compare the results with those achieved with the BPSK modulator. (05)

d) What are the three most predominant modulation schemes used in digital radio system? Explain the PLL based FSK system with relevant diagram. (09)

7. a) What is a spread spectrum system? Briefly describe its frequency hopping type using transmitter and receiver block diagrams. (09)

b) What can be gained from the apparent waste of spectrum in spread spectrum system? (05)

c) Show the schematic representation of FFT/IFFT based Orthogonal Frequency Division Multiplexing (OFDM) and explain how problems of Multi Carrier Modulated (MCM) system overcome in OFDM. (12)

d) Explain the coherent and non-coherent detection techniques. How does the DPSK eliminate the need for a coherent reference signal at the receiver? (09)

8. a) Derive the expression of impulse response for a matched filter and show that for maximization of output signal to noise ratio, the impulse response is delayed and time reversed version of the input signal. (12)

b) For an optimum binary receiver, show that the probability of bit error

$$P_b = Q\left(\sqrt{\frac{E_p + E_q - 2E_{pq}}{2N}}\right), \text{ and} \quad (13)$$

the optimum threshold $a_0 = \frac{1}{2}\left(E_p - E_q\right)$, where the symbols have their usual meaning.

c) It is required to transmit 2.08×10^6 binary digits per second with $P_b \leq 10^{-6}$. Three possible schemes are considered; (i) Binary, (ii) 16-ary ASK, and (iii) 16-ary PSK. The channel noise PSD is $S_n(w)=10^{-8}$. Determine the transmission bandwidth and the signal power required at the receiver input is each case. (10)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 2nd Term Examination, 2017

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) How are the electromagnetic fields generated by the source, contained and guided within the transmission line and antenna, and finally detached from the antenna to form a free space wave? (12)

   b) Define the followings in the context of antenna engineering: (09)
   (*i*) HPBW and FNBW, (*ii*) Radiation intensity, and (*iii*) Radian and Steradian.

   c) A lossless resonant half-wavelength dipole antenna, with input impedance of 73 ohms, is to be connected to a transmission line whose characteristic impedance is 50 ohms. Assuming that the pattern of the antenna is given approximately by- (08)
   $$U = B_o \sin^3\theta$$
   Find the overall maximum gain of this antenna.

   d) Find the average power radiated by a typical antenna. (06)

2. a) "The total capture area of an antenna is equal to the sum of effective area, scattering area and loss area" – justify the statement. (13)

   b) Deduce the general expression of the effective area of an antenna. Reduce the expression under following conditions; (14)
   (i) The antenna is being polarization matched and
   (ii) The antenna under test is matched to the load

   c) The effective antenna temperature of a target at the input terminals of the antenna is 150K. Assuming that the antenna is maintained at a thermal temperature of 300k and has a thermal efficiency of 99% and it is connected to a receiver through an X-band (8.2 – 12.4 GHz) rectangular waveguide of 10 m (loss of waveguide = 0.13 dB/m) and at a temperature of 300K, find the effective antenna temperature at the receiver terminals. (08)

3. a) Transmitting and receiving antennas operating at 1 GHz with gains (over isotropic) of 20 and 15 dB, respectively, are separated by a distance of 1 Km. Find the maximum power delivered to the load when the input power is 150 W. Assume that the antennas are polarization-matched. (07)

   b) Show that $A_z = \frac{\mu}{4\pi}\iiint_v J_z \frac{e^{-jkr}}{r} dv'$ is a solution to $\nabla^2 A_z + K^2 A_z = -\mu J_z$. (11)

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

   d) Draw the current distributions of a linear wire antenna of length $l = \lambda/4, \lambda/2, \lambda, 3\lambda/2, 2\lambda$. (05)

4. a) Derive the expression of radiated fields of infinitesimal dipole. (12)

   b) Draw the equivalent circuit of a loop antenna in transmitting mode. How can we increase the radiation resistance of a loop antenna? (13)

   c) Find the radiation resistance of a single turn and a 6-turns small circular loop. The radius of the loop is $\lambda/25$ and the medium is free space. Also draw the equivalent circuit of loop antenna in transmitting mode. (10)

SECTION B

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

5. a) What is meant by broadside array and endfire array? (08)
   b) Draw the radiation pattern for 8 isotropic elements feed in phase, using pattern multiplication. (07)
   c) What is minor lobe? Write down the disadvantages of minor lobe? (06)
   d) Mention the significance of tapering of antenna array. Also describe the tapering method of Binomial array. (14)

6. a) Define beam antenna. Find out the value of input impedance of Yagi-Uda antenna. (10)
   b) "Bidirectional radiation pattern can be converted into unidirectional of V-antenna" – Justify the statement. (08)
   c) For designing Rhombic antenna, find out the value of length $L = \frac{\lambda}{2\sin^2\beta}$ meter. (10)
   Where, the symbols have their usual meanings.
   d) How can we increase the power gain and directivity of V-antenna? (07)

7. a) Describe the Babinet's principle. (06)
   b) Write down the advantages of folded dipole antenna. (06)
   c) What are the modes of radiation of Helical antenna? Deduce the condition for pitch angle in order to get circular polarization of Helical antenna. (13)
   d) A paraboloid reflector antenna with diameter 20 meters is designed to operate at frequency of 6 GHz and illumination efficiency of 0.54. Calculate the antenna gain in decibels. (10)

8. a) What are the disadvantages of microstrip patch antenna and how it be overcome? (07)
   b) Write down the advantages and disadvantages of cassegrain antenna. How these disadvantages can be overcome? (08)
   c) Find out the spacing factor and apex angle for the log periodic antenna. (10)
   d) A loop antenna is made by winding 10 turns of wire on one square meter frame and is located in a magnetic field of 0.015 μ teslas at 10 MHz for maximum signal reception. Find (*i*) Induced emf on it and (*ii*) Terminal voltage of the antenna is turned to resonate with 65 ohms resistance in series with a 25 pf capacitor. (10)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 2nd Term Examination 2017

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) Define database and DBMS with example. What is data model? Describe different types of data models. (10)
   b) Describe about the modification of Database System with example(s). (14)
   c) What is meant by repetition of information and inability to represent information? Explain with example. (11)

2. a) Define and classify Normalization in database system. (06)
   b) Write the difference between 1NF and 2NF. (05)
   c) Suppose there is a company wherein employees work in more than one department. They store the data like this: (14)

EmpId	EmpNationality	EmpDept	DeptType	DeptEmpNo
1001	Austrian	CSE	D001	200
1001	Austrian	ECE	D001	250
1002	American	EEE	D134	100
1002	American	IEM	D134	600

Functional dependencies in the table above

$EmpId \rightarrow EmpNAtionality$

$EmpDept \rightarrow \{DeptType, DeptEmpNo\}$

Candidate Key: $\{EmpID, EmpDept\}$

IS the above table in BCNF or not? If it is not, then break the above table to comply with BCNF.

   d) Differentiate between super key and candidate key. Compute the closure of the following set F of functional dependencies for relation schema: (10)

$R = \{A, B, C, D, E\}$

$F = \{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$

List the candidate keys for R.

3. a) What do you mean by Relational Database? (06)
   b) Explain Functional Dependencies with example. (07)
   c) In designing a relational database, why might we choose a non-BCNF design? Explain in brief. (09)
   d) A University maintains data about the following entities: (13)
      (i) Course includes course number, title, credits, references, instructor-id, and domain.
      (ii) Course offering includes course number, year, term, section number, timing and class room.
      (iii)Students includes student-id, name and department.
      (iv)Instructor includes instructor-id, name, department and title.

Develop an ER diagram for the system.

4. a) How can we use Functional Dependencies to determine keys, prime attribute and non-prime attribute? Give example. (08)
   b) Write the features of good functional Decomposition. (06)
   c) What do you mean by Query-by-Example? Write the distinctive features of QBE. (09)
   d) Write QBE assuming any relation/table considering Smith and Jones are the values of the attribute customer name: (12)
      (i) To find all branches those have assets greater than those of at least one branch located in Brooklyn.
      (ii) To find the loan numbers of all loans made to Smith, to Jones.

SECTION B

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

5. a) Define dense and sparse indices. Give an example of each. (08)
   b) What are the index evaluation metrices? Briefly describe them. (08)
   c) Define B+ tree. What are the advantages of B+ tree index file? (07)
   d) Construct a B+ tree for the following data: (12)
   (2,5,7,3,17,11,19,32,2,3,19,45,67,12) with N=4. Show each step for the tree construction.

6. a) Define transaction for a database. Draw and explain the state transition diagram of a transaction. (08)
   b) What is concurrency control? Why do we need concurrency control for database transaction? Briefly explain with proper example. (12)
   c) 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)? (15)

Time	T_1	T_2	bal_x
t_1		begin-transaction	100
t_2		Read(bal_x)	100
t_3		$bal_x = bal_x + 100$	100
t_4	Begin-transaction	Write (bal_x)	200
t_5	Read(bal_x)		200
t_6	$Bal_x = bal_x - 10$	rollback	100
t_7	Write(bal_x)		190
t_8	commit		190

7. a) What is deadlock? When does it occur? (07)
   b) Discuss the issues related to database security. (08)
   c) "View makes complex query simple"-Justify the statement. (08)

d) Consider a table called student having the following columns and data types: (12)
roll_no number (4) primary key
name varchar (50) NOT NULL
marks number (3)
grade varchar (1)
course_id number (4)
Consider the following grade conversion list:

marks ≥80 grade=A^+
marks ≥75 and marks ≤79 grade=A
marks ≥70 and marks ≤74 grade= A^-
marks ≥65 and marks ≤69 grade= B^+
marks ≥60 and marks ≤64 grade= B
marks ≥55 and marks ≤59 grade= B^-
marks ≥50 and marks ≤54 grade=C^+
marks ≥45 and marks ≤49 grade=C
marks ≥40 and marks ≤44 grade= D
marks <40 grade=F

Now, create a trigger on student table so that when you insert or update marks field the grade field should automatically be updated or filled.

8. a) What is meant be domain constraints in a relation? What are the domain constraints that can be applied on a relation? Describe with proper example. (10)
b) What is view? What are the criteria to make a view updateable? (07)
c) How the remapping of bad sectors by disk controllers does affects data-retrieval rates? (10)
d) "Datatype is a physical thing while domain is a logical thing"-Justify the statement. (08)