2013 – 2014
M. TECH. AUTUMN (I SEMESTER) EXAMINATION
(ELECTRONICS ENGINEERING)
COMMUNICATION & INFORMATIONS SYSTEM/
 ELECTRONIC CIRCUITS & SYSTEM DESIGN
ADVANCED MATHEMATICS
(AM-651)

Max. Marks: 60
Duration: Three Hours

Note: Attempt any five questions, selecting at least one question from each section.

1. (a) What are linearly dependent and independent sets? Show that the sets of vectors
$v_1 = (1, -1, 0), v_2 = (0, 1, -1), v_3 = (0, 2, 1), v_4 = (1, 0, 3)$ are linearly dependent. [6+6]

(b) Let $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$ be the linear transformation defined by
$T(x, y) = (2x + 3y, 4x - 5y)$. Find the matrix representation of $T$ relative to the
basis $B = \{u_1, u_2\} = \{(1, 2), (2, 5)\}$

2. (a) Define orthogonal and orthonormal sets. Apply the Greim-Schmidt orthogonalization process to find an orthogonal basis then an orthonormal basis for the
subspace $U$ of $\mathbb{R}^4$ spanned by $v_1 = (1, 1, 1, 1), v_2 = (1, 2, 4, 5), v_3 = (1, -3, -4, -2)$. [6+6]

(b) Let $V$ be the set of all ordered pairs $(x, y)$, where $x, y$ are real numbers.
Let $a = (x_1, y_1), b = (x_2, y_2)$ be two elements in $V$. Define the addition
as $a + b = (x_1, y_1) + (x_2, y_2) = (2x_1 - 3x_2, y_1 - y_2)$ and the scalar multiplication
as $\alpha (x_1, y_1) = (\alpha x_1/3, \alpha y_1/3)$
Show that $V$ is not a vector space. Which of the properties are not satisfied?

SECTION - B

3. (a) Two discrete random variables $X$ and $Y$ have the joint probability density function
$[(x, y) = \frac{\lambda^x e^{-\lambda} p^y (1 - p)^{x-y}}{y!(x-y)!}, y = 0, 1, 2... x = 0, 1, 2...]$
where $\lambda, p$ are constants with $\lambda > 0$ and $0 < p < 1$. Find
(i) The Marginal Probability density functions of $X$ and $Y$.
(ii) The conditional distribution of $Y$ for a given $X$ and of $X$ for a given $Y$.

(b) If $X_1, X_2, ..., X_n$ are independent observations from a negative exponential distribution with the parameter $\lambda$. Then estimate the parameter $\lambda$ using the method of least squares and show that it is equal to the sample mean.

4. (a) If $X$ and $Y$ are two random variables having the joint density function $f(x, y) = \frac{1}{27} (2x + y)$, where $x$ and $y$ can assume only the integer values $0, 1$ and $2$. Find
(i) The marginal distribution of $X$ and $Y$.
(ii) The conditional distribution of $Y$ for $X = x$

(b) What are random numbers? Describe any one method of its generation.

Contd....2,
5. (a) A population consists of four numbers 2, 3, 4, 5. Consider all possible distinct 
sample of size two with replacement. Find 
(i) The population mean 
(ii) The population standard deviation 
(iii) The sampling distributions of means 
(iv) The mean of the sampling distributions of mean 
(v) Standard deviations of sampling distribution of mean.

(b) Fit a least squares straight line for the following data

<table>
<thead>
<tr>
<th>X</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

and calculate Y at X = 4.

SECTION - C

6. (a) Out of two vending machines at a super bazaar the first machine fails to work 13 
times in 250 trials and second machine fails to work 7 times in 250 trials. Test at 
0.05 level of significance whether the difference between the corresponding 
proportions is significant. Given 0.05 level of significance 
-1.96 < z < 1.96.

(b) Find a least squares quadratic curve to the following data:

<table>
<thead>
<tr>
<th>X</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>1.7</td>
<td>1.8</td>
<td>2.3</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Estimate Y (2.4)

7. (a) Show that \( J_2'(x) = \left(1 - \frac{4}{x^2}\right)J_1(x) + \frac{2}{x}J_0(x) \)

(ii) Evaluate \( \int J_1(x) \, dx \)

(b) Evaluate \( \int x^2J_1(x) \, dx \)

(ii) Evaluate \( \int x^3J_5(x) \, dx \)
2013-14
M.Tech. (I Semester) Examination
ELECTRONICS ENGINEERING
Digital System Design using HDL
EL 626

Maximum Marks: 60
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Question M.M.
1(a) Why is HDL needed for the design of large size digital systems? What are its main features? [04]
1(b) Differentiate between top-down and bottom-up approach in the design of large scale systems. [03]
1(c) Design a 4-bit Ripple carry adder using the bottom-up approach. Give the corresponding Verilog code. [08]
2(a) Give a flowchart describing the sequence of steps in HDL based modelling, verification, and synthesis. [04]
2(b) What do you understand by a ‘module’ in HDL? Differentiate between gate-level, data-flow and behavioural modelling styles. [05]
2(c) Write a Verilog code and test bench for 8x1 MUX, making use of tri-state gates. [06]
3(a) What are ASM and ASMD charts? How do they help in designing circuits having large number of states? [05]
3(b) Using a suitable example, like traffic light controller or binary multiplier, illustrate the design steps using ASMD charts. [10]

OR

3’ (a) What is meant by equivalent states? Examine the state diagram of fig.1 and perform state reduction for machine minimisation. [05]
3’(b) What are the different codes used for state assignment? Give the advantage of one-hot codes. [05]

Contd……..2
3(e) Give the state diagram of a circuit that detects a sequence of four or more consecutive 1's in a serial bit stream.

4(a) Write a Verilog code and test bench for a Mealy FSM zero detector shown in fig.2. How does the Verilog model correspond to the hardware?

4(b) Model the behaviour in Verilog, of a Moore FSM having the state diagram shown in fig.3, using only one 'always' block.

OR

4'(a) Write a Verilog code and test bench of a Modulo-8 Up-down counter.

4'(b) Write a Verilog code and test bench of a sequential binary multiplier.

FIGURES

![Fig. 1](image1)

![Fig. 2](image2)

![Fig. 3](image3)
M.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
(Communication & Information Systems)
VOICE AND PICTURE CODING
EL-653

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer any four (two from each section) questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Question M.M.

SECTION-A

1(a) Draw the block diagram of acoustic model of acoustic signals. Explain the role of each and every block. [03]
1(b) Differentiate clearly between pitch and formant frequencies. How these frequencies are determined in the audio signals. What role they play in the speech generation model? [03]
1(c) What are the methods used to differentiate between voiced and unvoiced speech? [02]
1(d) What do you mean by bark frequencies? Why bark scale is needed? Give the relationship between bark frequency and frequency in hertz. [03]
1(e) Differentiate between the threshold of hearing and masking threshold in human hearing system. Explain various frequency masking parameters and give relationship among them. [04]

2(a) What is the role of predictor in DPCM-based speech coding system? Show that the differential quantization and prediction can reduce the average bit rate. [04]
2(b) In the design of an adaptive quantizer, there are different methods to achieve adaptation. Explain each of them with the help of suitable block diagrams. Also list their relative advantages and disadvantages. [05]
2(c) Why μ-law and A-law compandors use logarithmic transformation function? Show that the optimum mean square, zero-memory quantizer for a uniformly distributed

Contd......2
random variable achieves the rate-distortion characteristics of the Shannon quantizer for a Gaussian distribution having the same variance.

3(a) What are the differences among waveform-based coders, model-based coders and hybrid coders used in speech coding? Differentiate in terms of techniques used, bit-rate and quality (measured in MOS).

3(b) The linear predictive coding (LPC) is widely used in low bit-rate speech coding. Discuss the fundamental principles of LPC coders. Name the different variants of LPC coders.

3(c) Compare the scalar and vector quantizers in terms of rate-distortion performance. Explain the LBG algorithm used to design the vector quantizer.

OR

3(e') Explain the Levinson-Durbin algorithm. How it helps in the design of LPC-based speech coders?

SECTION-B

4(a) What is the chromaticity diagram? Explain its significance in colour mixing. Describe the properties of chromaticity diagram.

4(b) What are the different types of receptors in the human eye? What role they play? Describe them briefly.

4(c) An image described by the function \( f(x, y) = 2\cos(2\pi(3x + 4y)) \) is sampled such that \( \Delta x = \Delta y = 0.2 \). The reconstruction filter is an ideal low-pass filter with bandwidth \( (\frac{1}{2} \Delta x, \frac{1}{2} \Delta y) \). Find the image reconstructed from its samples.

5(a) For the 2\times2 transform \( A \) and image \( U \) given below, calculate the transformed image \( V \) and the basis images. Also show that the reconstructed image from the transformed coefficients is equal to the original image.

\[
A = \frac{1}{2} \begin{bmatrix} \sqrt{3} & 1 \\ -1 & \sqrt{3} \end{bmatrix}, \quad U = \begin{bmatrix} 2 \\ 3 \\ 1 \\ 2 \end{bmatrix}
\]

5(b) Show that the discrete cosine transform (DCT) of an \( N \times 1 \) sequence \( \{u(0), u(1), ..., u(N - 1)\} \) can be calculated from DFTs of \( 2N \times 1 \) symmetrically.

Contd.....3
extended sequence \( \{u(N-1), u(N-2), \ldots, u(1), u(0), u(1), \ldots, u(N-1)\} \).

5(c) Name the transforms having rectangular signals as their basis functions. Describe one of them in detail.

6(a) What do you mean by scalability in image coders? Differentiate clearly between SNR and resolution scalabilities.

6(b) Almost all standard image and video coders (except JPEG 2000) are based on discrete cosine transform. Why?

6(c) In JPEG image coder, DC coefficients are differentially coded, whereas AC coefficients are coded using zig-zag scanning. State the reasons.

6(d) In a subband coder, what are the roles played by analysis filter bank, synthesis filter bank, up-sampling and down-sampling.

6(e) What are the major advantages of discrete wavelet transform over DFT and DCT?
Answer any Four Questions.
Assume suitable data if missing.
Symbols used have their usual meanings.

Q1(a) What are radar beacons? What applications do they have?
Q1(b) The radar antenna diameter is 1000 ft, it has a transmitted pulse power of 40 Mw, the frequency is 2.4 GHz, the bandwidth is 10 Hz. The transponder has an 8-ft diameter paraboloid reflector antenna, and a receiver noise figure of 4.77 dB, what is the maximum range for interrogation link?

Q2(a) Discuss the merits and limitations of pulse compression.
Q2(b) Find the range resolution before and after pulse compression for the linear filter waveform having a band width of 0.5 GHz and pulse width of 5 ms.

Q3 With the help of block diagram explain the principle and working of airborne weather radar system.

Q4 (a) Discuss the effect of earth on the propagation of radar waves.
Q4(b) Calculate the range to horizon and also the corresponding depression angle of a radar at 10,000 and 20,000 ft of altitude.

Q5 What are the hyperbolic systems? Discuss any two of them.

Q6 With the help of necessary illustrations describe the working of instrument landing system.
2013-14  
M.TECH. (AUTUMN SEMESTER) EXAMINATION  
ELECTRONICS ENGINEERING  
COMPUTER NETWORKS  
EL-681  

Maximum Marks: 60  
Credits: 04  
Duration: Three Hours  

Answer any FOUR questions.  
Assume suitable data if missing.  
Notations used have their usual meaning.  

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
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<tbody>
<tr>
<td>1(a)</td>
<td>Differentiate among a port address, a logical address and a physical address.</td>
<td>[05]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Describe Character-Oriented protocol of variable-size framing at data link layer. Why there is need of byte stuffing?</td>
<td>[05]</td>
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<tr>
<td>1(c)</td>
<td>Distinguish between 10Base2, 10Base5 and 10Base-F</td>
<td>[05]</td>
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<tr>
<td>2(a)</td>
<td>What is Point to Point protocol? Show the frame format. Also draw the transition phase diagram.</td>
<td>[05]</td>
</tr>
<tr>
<td>2(b)</td>
<td>In figure shown below, computer A sends a message to computer D via LAN1, router R1 and LAN2. Show the contents of the packets and frames at the network and date link layer for each hop interface.</td>
<td>[05]</td>
</tr>
<tr>
<td>2(c)</td>
<td>Differentiate between the connectionless and connection oriented service. Also differentiate between the reliable and unreliable service.</td>
<td>[05]</td>
</tr>
<tr>
<td>3(a)</td>
<td>Describe briefly the standards available for Gigabit Ethernet.</td>
<td>[05]</td>
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<tr>
<td>3(b)</td>
<td>What is Distributed Coordination Function (DCF)? Show the handshaking frame exchange time line diagram. Also state the importance of NAV.</td>
<td>[05]</td>
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<tbody>
<tr>
<td>3(c)</td>
<td>Explain the addressing mechanism of IEEE 802.11. [05]</td>
</tr>
<tr>
<td>4(a)</td>
<td>Explain the physical to logical address mapping protocols BOOTP and DHCP. [05]</td>
</tr>
<tr>
<td>4(b)</td>
<td>With regard to Bluetooth, (i) distinguish between SCO and ACL type of links, (ii) distinguish between piconet and scatternet. [05]</td>
</tr>
<tr>
<td>4(c)</td>
<td>An ISP is granted a block of addresses starting with 120.60.4.0/22. The ISP wants to distribute these blocks to 100 organisations with first 50 receiving just eight addresses each and rest receiving four addresses each. Design the sub-blocks and give the slash notation for each sub-block. Find out how many block addresses are still available after allocations. [05]</td>
</tr>
<tr>
<td>5(a)</td>
<td>What is SONET/SDH? Show the block diagram of simple SONET network and explain each device function. [05]</td>
</tr>
<tr>
<td>5(b)</td>
<td>Describe the architecture of IEEE 802.11. [05]</td>
</tr>
<tr>
<td>5(c)</td>
<td>What is ICMP? Describe the error reporting messages generated by ICMP in case of errors. [05]</td>
</tr>
<tr>
<td>6(a)</td>
<td>Compare the routing mechanism of Multicasting and broadcasting. Also state the advantages of multicasting over multiple unicasting. [05]</td>
</tr>
<tr>
<td>6(b)</td>
<td>Using the Dijkstra’s Shortest Path algorithm develop the shortest path tree, considering G as the root node, for the network shown below. [05]</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
</tbody>
</table>
| 6(c) | Write short notes on any TWO of the following: [05]  
(i) Distance vector routing  
(ii) Flooding  
(iii) RIP  
(iv) Expose station problem |