B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
COMPUTER ARCHITECTURE
CO-460

Maximum Marks: 60
Credits: 04
Duration: Two Hours

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

Q.No. Question M.M.
1(a) For a 3-level memory hierarchy, let $M_i$ be the Miss ratio of the $i^{th}$ level and $t_i$ be the [05]
time of memory access at level $i$. For $M_1 = 12\%, M_2 = 9\%, t_1 = 0.2\mu s, t_2 = 0.4\mu s$ and
$t_3 = 0.7\mu s$, find out the average memory access time.

1(b) Discuss the direct mapping technique for the cache memory. Explain the reasons [10]
behind moving a block of words from main memory to cache memory even in case
of a single miss.

2(a) With the help of suitable examples, differentiate between a macro-operation and a [5]
macro-operation.

2(b) Design a 4-bit barrel shifter for the following operations: [10]

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Selection Code</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>000</td>
<td>No Shift</td>
</tr>
<tr>
<td>(ii)</td>
<td>001</td>
<td>Shift-right, $I_R=0$</td>
</tr>
<tr>
<td>(iii)</td>
<td>010</td>
<td>Shift-left, $I_L=0$</td>
</tr>
<tr>
<td>(iv)</td>
<td>011</td>
<td>0's to output bus</td>
</tr>
<tr>
<td>(v)</td>
<td>100</td>
<td>Circulate right with C</td>
</tr>
<tr>
<td>(vi)</td>
<td>101</td>
<td>Circulate left with C</td>
</tr>
<tr>
<td>(vii)</td>
<td>110</td>
<td>Shift-right by two positions, $I_R=0$</td>
</tr>
<tr>
<td>(viii)</td>
<td>111</td>
<td>Shift-left by two positions, $I_L=0$</td>
</tr>
</tbody>
</table>

OR

cont'd... 2
2. Sketch and explain the block diagram of a processor that uses the following table of control variable for various functions.

<table>
<thead>
<tr>
<th>Binary Code</th>
<th>A</th>
<th>B</th>
<th>D</th>
<th>F with $C_{in}=0$</th>
<th>F with $C_{in}=1$</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>000</td>
<td>Input Data</td>
<td>Input Data</td>
<td>None</td>
<td>$A, C\leftarrow 0$</td>
<td>$A+1$</td>
<td>No Shift</td>
</tr>
<tr>
<td>001</td>
<td>$R_1$</td>
<td>$R_1$</td>
<td>$R_1$</td>
<td>$A+B$</td>
<td>$A+B+1$</td>
<td>Shift-right, $I_R=0$</td>
</tr>
<tr>
<td>010</td>
<td>$R_2$</td>
<td>$R_2$</td>
<td>$R_2$</td>
<td>$A-B-1$</td>
<td>$A-B$</td>
<td>Shift-left, $I_L=0$</td>
</tr>
<tr>
<td>011</td>
<td>$R_3$</td>
<td>$R_3$</td>
<td>$R_3$</td>
<td>$A-1$</td>
<td>$A, C\leftarrow 1$</td>
<td>0’s to output bus</td>
</tr>
<tr>
<td>100</td>
<td>$R_4$</td>
<td>$R_4$</td>
<td>$R_4$</td>
<td>$A\lor B$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>101</td>
<td>$R_5$</td>
<td>$R_5$</td>
<td>$R_5$</td>
<td>$A\oplus B$</td>
<td>-</td>
<td>Circulate right with $C$</td>
</tr>
<tr>
<td>110</td>
<td>$R_6$</td>
<td>$R_6$</td>
<td>$R_6$</td>
<td>$A\land B$</td>
<td>-</td>
<td>Circulate left with $C$</td>
</tr>
<tr>
<td>111</td>
<td>$R_7$</td>
<td>$R_7$</td>
<td>$R_7$</td>
<td>$\bar{A}$</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

3. With the help of a suitable block diagram, describe the functioning of a generic Microprogram Sequencer.

OR

3'. With the help of a suitable example, explain the concept of overlapped register windows in RISC processors.

4(a) What do we mean by the fault tolerance of an interconnection network? Find out the diameter of the following networks, each with $n$ nodes.

(i) Fully connected Network
(ii) Linear Array
(iii) Ring
(iv) Hypercube
(v) 2-D Mesh

4(b) With the help of a suitable data flow diagram, discuss an arithmetic pipeline for floating point addition and subtraction.
2016-17
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRONICS ENGG.
ANALOG IC DESIGN
EL 412

Maximum Marks: 60  
Credits: 04  
Duration: Two Hours

Answer all the questions. 
Assume suitable data if missing.
Supplement your answers with neat circuit/block diagrams, wherever necessary.

Q.No.  

1(a) Figure 1 shows distribution of a reference for biasing an analog chip. What are the problems associated in the scheme; and how can these be overcome?

1(b) How can sensitive analog line(s) be protected from crosstalk in mixed signal environment?

1(c) “One dimensional cross coupling reduces the linear gradient effect”. Justify the statement with an example, if $C_{ox}$ is the parameter of concern.

2(a) Find the small signal voltage gain and the -3dB frequency (in Hz.) for the active loaded ($M_2$) inverting amplifier ($M_1$), if ($W/L_1$)=5μm/1μm; if ($W/L_2$)=2μm/1μm. Assume dc current as 100μA, $C_{gd1}=4\text{fF}$, $C_{bd1}=10\text{fF}$, $C_{gd2}=4\text{fF}$, $C_{bd2}=10\text{fF}$, $C_{gs2}=5\text{fF}$ and $C_1=10\text{pF}$. Assume $|V_T|=0.7\text{V}$, $K'_n=2.2K'_p$.

2(b) For the circuit as shown in figure 2, prove that the differential voltage gain is $(4/3)g_{m1}R_D$. Assume that the bias values of both $V_{in1}$ and $V_{in2}$ are equal.

Figure 1

Total Marks: 80

Contd... 2.
2' Analyze the two-stage CMOS opamp, shown in figure 3 for small signal voltage gain. Also identify the parasitic capacitances in the circuit. Find the expressions for unity gain frequency and bandwidth.

3(a) Realize a switched capacitor floating resistor and design an integrator circuit for $T=0.1\text{ms}$, if clock frequency is $1\text{MHz}$.

3(b) Design a switched capacitor precision multiply by two circuit.

OR

3' Write detailed technical note on FPAAAs, emphasizing on the design of configurable analog blocks.

4(a) Show the design process flow of analog integrated circuits.

4(b) What are the design challenges in analog integrated circuits?
2016-17
B.TECH. (AUTUMN) VII SEMESTER EXAMINATION
(ELECTRONICS ENGINEERING)
DIGITAL INTEGRATED CIRCUITS
(EL-413)

Maximum Marks: 60 Credits: 04 Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Assume Vtn=0.43V, Vtp=-0.4V, V_{DSATn}=0.63V, V_{DSATp}=-1V, K_n=115E-6A/V²,
K_p=-30E-6A/V², \lambda n=0.06/V, \lambda p=-0.1/V, V_{DD}=2.5V

Q.No. Question M.M.

1(a) Compute \( V_{OH}, V_{OL} \) and \( V_M \) of the circuit shown in Fig. 1. [05]

1(b) Why is the interconnect delay crucial at the nanoscale? Justify. [04]

1(c) Draw the layout of a circuit that implements the Boolean function \( F = (AB + C)' \) after sizing it properly. Assume that both normal and complement inputs are available. Find the input combination for maximum delay. [06]

OR

1'(c) Draw the layout of a circuit that the Boolean function \( F = (AB + CD)' \) after sizing it properly. Assume that both normal and complement inputs are available. [06]

2(a) What is the voltage swing on the output node in Fig. 2? Estimate the energy drawn from the supply for a 0V to 2.5V transition at the input. Compute \( V_{OH} \) [07]

2(b) Determine the sizing of \( C_{out} \) output of a full adder which requires two additional inverters at the output to drive a capacitive load 1000 times times its input. Also compute the value of the minimum delay. [08]

3(a) What are the problems associated with dynamic logic and pass transistor logic? Which logic will most likely dominate at the nanoscale and Why? [05]

OR

3'(a) Realize a full adder circuit using minimum number of transmission gates and inverters. What is its importance? [05]

3(b) What is the importance of logical effort 'g' and intrinsic delay 'p' in combinational gates? Determine the value of 'g' and 'p' for an XNOR gate after drawing its circuit. [05]
3'(b) Find the safe value of switching threshold voltage of the inverter which is being driven by a four input dynamic NAND gate. Assume that the value of its load capacitance is 20 times the individual internal node capacitance.

3(c) Implement a 2-bit ripple adder using Domino logic

3'(c) Implement a 2-bit ripple adder using np-CMOS logic

4(a) Explain briefly the different parameters on which the clock frequency of a sequential circuit depend. What is the constraint on the hold time?

4(b) Discuss briefly the design of a C$^2$MOS register? How is this circuit immune to clock overlap?

4'(b) Compute the setup time and clock to Q delay of a static transmission gate based master/slave negative edge triggered FF. What is the problem with this circuit?

4(c) An Enable signal has to be inserted in a ratioed clocked CMOS SR latch such that the latch functions only when Enable = 1. Determine the transistor sizes of the clocked CMOS SR latch with Enable signal for proper operation. Assume standard sizes for 0.25u technology of transistors forming the regenerative inverter pair with $V_{M}=V_{DD}/2$.

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$V_{DD}=2.5\text{V}$

![Fig. 1](image)

![Fig. 2](image)
2016-17
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS
EL-432N

Maximum Marks: 60
Credits: 04
Duration: Two Hours

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

Q.No.  Question  M.M.
1(a)  Classify each of the following as either a contradiction, a tautology or a satisfiable non-
tautology. Justify each answer.
a. \((A \lor B) \land (\neg B \lor C) \Rightarrow (A \lor C)\)
b. \(((A \Rightarrow B) \land (B \Rightarrow A)) \Leftrightarrow (A \Leftrightarrow B)\)

OR

1(a')  S1: If the maid stole the jewelry, then the butler wasn't guilty.
S2: Either the maid stole the jewelry or she milked the cows.
S3: If the maid milked the cows, then the butler got his cream.
S4: Therefore, if the butler was guilty, then he got his cream.
Show that the conclusion S4 is valid using resolution in propositional calculus.

1(b)  Given the assertions,
P1: If something has hair and gives milk, it is a mammal;
P2: All things that are coconuts have hair;
P3: All things that are coconuts give milk;
P4: All coconuts are mammals;
Show that the P4 is logically implied by P1, P2, P3 using resolution method in predicate calculus.

OR

1(b')  Given the assertions,
Q1: If a perfect square is divisible by a prime p, then it is also divisible by square of p.
Q2: Every perfect square is divisible by some prime.
Q3: 36 is a perfect square.
Q4: There exists a prime q such that square of q divides 36.
Show that the Q4 is logically implied by Q1, Q2, Q3 using resolution method in predicate
1(c) Describe the architecture of a Rule Based Expert System, with the help of a block diagram. Explain backward reasoning and forward reasoning mechanisms used for inference in an expert system.

2(a) What is the difference between the average and the effective branching factor?

2(b) With breadth-first search for the 8-puzzle, find a path (manually) from the starting node to the goal node.

\[
\begin{array}{ccc}
1 & 2 & 3 \\
4 & 5 & 6 \\
7 & 8 \\
\end{array}
\]

2(c) The search tree for a two-player game is given in Fig.1 with the ratings of all leaf nodes. Use minimax search with \textbf{a-b pruning} from left to right. Cross out all nodes that are not visited and give the optimal resulting rating for each inner node. Mark the chosen path.

\[
\text{max} \quad \text{min} \quad \text{max} \quad \text{min}
\]

\[
\begin{array}{cccccccc}
22 & 74 & 18 & 14 & 100 & 10 & 50 & 42 \\
-91 & 7 & -38 & -92 & -17 & 28 & -22 & 48 \\
\end{array}
\]

Fig.1

3(a) Write short notes on:
   a.) Back-propagation learning algorithm
   b.) Feedback Neural Network

3(b) Design a multilayer perceptron network to implement exclusive-or (XOR) function.

3(b') Design a radial basis function network to implement exclusive-or (XOR) function.

4(a) Discuss the application of neural networks for clustering in web-browsing applications.

4(a') Discuss the application of neural network for function approximation in system modelling.

4(b) Write a short note on the application of neural networks for pattern recognition in ECG signals for detecting heart diseases.

4(b') Write a short note on the application of neural networks for prediction and control in robotics.
Maximum Marks: 60                        Credits: 04                        Duration: Two Hours

Answer all the questions. Each question is of 15 marks. Assume suitable data if missing. Notations used have their usual meaning.

Q.No.                      Question                                           M.M.

1(a)  Justify the statement: We are gradually moving towards “flawless telepresence” systems of future. [5]

OR

1'(a)  Give your comments about the possible difficulties that may be involved in development of products based on smell, taste and/or haptic communication. [5]

1(b)  Why is handwriting recognition process more difficult in the case of cursive handwriting compared to boxed discrete handwriting? [5]

1(c)  With regard to performance of voice recognition systems, distinguish between Insertion error and Substitution error. [5]

2(a)  An image has an aspect ratio of $m:n$ and a bit depth $b$. The longest diagonal within the image has a size $D$. Compute the file size of the image in terms of $m$, $n$, $b$ and $D$. [5]

2(b)  Why is CMYK model used in colour printing? [5]

OR

2'(b)  Give some features of JPEG-2000 which distinguishes it from JPEG. [5]

2(c)  With regard to image processing of images, differentiate between point operation and filtering. [5]
3(a) An input signal has a flat frequency spectrum in the range 0 to W Hz, and the signal does not have any frequency present outside this range. Do you think sub-band coding implementation for this signal can achieve compression? Why?

3(b) Briefly explain the role of motion estimation and motion compensation in a video coder.

3(c) A digitized video is to be compressed using the MPEG-1 standard. Assuming a frame sequence of IBBPBBPBBPBBI..., and average compression ratios of 10:1 for I-frames, 20:1 for P-frames, and 50:1 for B-frames, derive the average bit rate that is generated by the encoder for the PAL digitization format, assuming frame size 352 by 288 and chroma sub-sampling scheme 4:2:2.

OR

3'(e) With regard to video coding and transmission, what is meant by scalability?

4(a) Distinguish between movie-on-demand (MOD) and near movie-on-demand (NMOD).

4(b) With regard to networked multimedia, briefly explain the terms: jitter and skew. How can they be minimized?

4(c) Distinguish between transmission delay and propagation delay in a networked environment.

OR

4'(e) With regard to HTML, what is the significance of (i) Head, (ii) Body, and (iii) Title.
2015-16
B.TECH. (WINTER SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
MOBILE COMMUNICATION
EL 457

Maximum Marks: 60    Credits: 04    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)  Show that for an omni-directional antenna system, an N = 7 cell reuse pattern is required for signal-to-interference ratio of 18 dB.  [05]
1(b)  The capacity (no. of users per cell) of a cellular system depends how the interference is reduced. Discuss at least four methods that can be used to reduce the interferences in a cellular system.  [06]
1(c)  Differentiate between soft and hard handoff.  [04]
2(a)  Which of the following alternatives can be used to lower the outage probability of a system due to shadowing, and why are they/not possible to use?
     i. Increase the transmit power.
     ii. Decrease the deterministic pathloss.
     iii. Change the antennas.
     iv. Lower the shadowing variance.  [06]
2(b)  For a signal with Rayleigh-distributed amplitude, what is the probability that the received signal power is at least 10, and 20 dB below the mean power.  [04]
2(c)  A mobile system is to provide 95 percent successful communication at the fringe of coverage with a shadow fading component having a zero mean Gaussian distribution with standard deviation of 8 dB. What fade margin is required?  [05]

OR

2'(a)  Prove, for X and Y independent zero-mean Gaussian random variables with variance \( \sigma^2 \), that the distribution of \( Z = \sqrt{X^2 + Y^2} \) is Rayleigh distributed and that the

Contd.....2.
distribution of $Z^2$ is exponentially distributed

2'(b) For a Rayleigh faded envelope, find the percentage of time that a signal is 3 dB or more below the RMS value.

2'(c) Suppose the maximum fade duration over radio channel is 0.001 ms. Assume that all the bits are in error when a signal encounters a fade. What is the maximum number of consecutive bits that are in error for a transmission through this channel if the data rate is 10 kbps? If the data rate is 11 Mbps?

3(a) Prove that a Rayleigh fading signal has an exponential pdf for the power of the signal.

3(b) Calculate the time separation required for two signals to achieve a high degree of time diversity in a classical Rayleigh channel at 900 MHz with a mobile speed of 20 km/hour.

3(c) In an OFDM modem with 48 channels, each channel uses 16-QAM modulation. If the overall transmission rate is 10 Mbps, What is the symbol transmission rate per channel? Also, compare the bandwidth efficiency of the OFDM modem with conventional 16-QAM transmission with raised cosine pulse shaping with roll-off factor 0.3.

4(a) What functions are performed by BTS and BSC of a mobile network?

OR

4(a') Why rate adaptation is necessary for data transmission in GSM? Discuss rate adaptation for different interfaces in GSM.

4(b) How is the transmission of low data rates handled in the uplink and downlink of IS-95 system?

OR

4(b') How are Walsh codes employed in the IS-95 forward and reverse channels? Explain the difference.

4(c) What are some key characteristics that distinguish 3G cellular systems from 2G cellular systems?