2016-2017
VTH Semester B. Tech. Examination
(Computer Engg.)
DIGITAL ELECTRONICS (CO-308)
Credit - 04

Maximum Marks: 60 Duration: Two Hours

- Attempt All questions.
- Symbols and notation used have their standard meanings.
- Assume suitable data if required.

1(a) Design a 4-input NAND gate using Differential Pass Transistor Logic, and show that it is a static logic. 9
(b) Implement Function in \( f = (x + y)(\bar{x} + \bar{y}) \) in CMOS logic. OR 6
(b') Implement the above function in Pseudo NMOS logic. 6

2.(a) Explain the mechanism of reading and writing in EEPROM. How many transistors are required for storing single bit in EEPROM and why? 8
(b) How 2K X 4 PROM can be combined to produce a total capacity of 8K X 8. How many PROM chips are needed? How many address bus lines are required? Explain with the block diagram of the chip arrangement 7

3.(a) Does the inverter shown in figure (1) is ratioed or ratioless? Explain how the circuit works as an inverter and when the output will be considered as valid output. (\( \Phi \) is a clock signal). Use this inverter to construct a cell of shift register, and explain its operation. 9

(b) Sketch an 8-to-1 tree column decoder and explain how a column of a memory array is selected. 6
(b') Sketch the circuit of a differential sense amplifier circuit connected to the bit line of a column in SRAM. OR 6

4.(a) Describe the operation of Successive Approximation ADC (SAC) with the help of flowchart and block diagram. Plot the diagram for voltage \( V_{AX} \) (output of DAC) Vs time for a 4-bit SAC operation, if the analog voltage 11.3 V is to be converted, assume a resolution of 1 V of the DAC used in SAC. 8
(b) Explain the conversion of 4-bit digital value into a proportional analog value through binary weighted DAC. OR 7

4'.(a) Assume that the reference voltage \( V_{ref}=25 \) V in an inverting R/2R Ladder DAC. What is the resolution, Full Scale reading and weight of the individual bits of this DAC? 7
(b) How many comparators are used in a 9-bit Flash ADC? Sketch the Circuit of a 3-bit Flash ADC and select the value of the resistor R and \( V_{ref} \) such that the resolution of the converter holds a value of 0.5V. 8
2016-17
B.TECH. (AUTUMN SEMESTER) EXAMINATION
COMPUTER ENGINEERING
MICROPROCESSOR THEORY AND APPLICATION
CO-309

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)  A set of N 8-bit numbers is stored from memory location 2051H onwards, the [08]
number N is stored at memory location 2050H. Write an assembly language program in 8085 to sort the numbers in ascending order.

1(b)  Draw the timing and control diagram for the instruction IN 01H stored at the [07]
memory locations 2050H-2051H. IN has hex code DB and port 01H send data 55H to the microprocessor.

2(a)  Show the content of the stack pointer, address bus, program counter, data bus and [08]
internal registers during execution of instruction CALL 2070H and RET. Stack pointer is initialized with a value of 2400H. Call instruction is stored at memory location 2040H and RET is stored at memory location 207FH.

2(b)  The Programmable Counter/Interval Timer 8253 is operating in Mode 0. Write a [07]
program in 8085 to generate interrupt on terminal count.

3(a)  Generate a Delay Subroutine using register pair BC. Write the assembly language [08]
code in 8085, T-states of instructions and calculate the delay for BC=FFFFH.

3(b)  The Programmable Peripheral Interface 8255 is operating in BSR mode. Write an [07]
assembly language program in 8085 to set the bits PC7 and PC3 and then reset them.

continued
3'(a) The Programmable Peripheral Interface 8255 is operating in mode 0, with port A & port C\textsubscript{U} as output port and port B & port C\textsubscript{L} as input port. Write an assembly language program in 8085 to move content of port B to port A and port C\textsubscript{L} to port C\textsubscript{U}.

3'(b) Draw and explain the pin diagram of Programmable Interrupt Controller 8259.

4(a) Discuss the advantages and disadvantage of CISC and RISC processor design strategies.

4(b) Distinguish between microprocessor, microcontroller and co-processor giving one example of each.

OR

4'(a) Explain the concept of physical address and logical address with the help of segment registers and offset registers in 8086.

4'(b) Draw the Execution Unit and Bus Interface Unit of the 8086 microprocessor.
Answer all the questions.  
Assume suitable data if missing.  
Notations used have their usual meanings.

Q.No | Question | MM
---|---|---
1(a) | Describe the differences among short-term, medium-term, and long-term scheduling. | [7]
OR
(a') | Explain the differences in the degree to which the following scheduling algorithms discriminate in favour of short processes:
(i) First-Come First-Serve (FCFS)
(ii) Round Robin (RR)
(iii) Multilevel Feedback Queues (MLFQ) |
(b) | Consider a system running ten I/O bound tasks and one CPU bound task. Assume that the I/O bound tasks issue an I/O operation once for every millisecond of CPU computing and that each I/O operation takes 10 milliseconds to complete. Also, assume that the context-switching overhead is 0.1 millisecond and that all processes are long running tasks. What is the CPU utilization for a round-robin scheduler when the time quantum is: (i) 1 millisecond, (ii) 10 milliseconds? | [8]

2(a) | Describe the requirements that are to be satisfied by a solution to the critical section problem. | [7]
OR
(a') | What are semaphores? How semaphores can be used to implement mutual exclusion? |
(b) | A file is to be shared among different processes, each of which has a unique number. The file can be accessed simultaneously by several processes, subject to the following constraint: The sum of all unique numbers associated with all the processes currently accessing the file must be less than n. Write a monitor to coordinate access to the file. | [8]
3(a) Consider the deadlock situation that could occur in the dining philosophers problem when the philosophers obtain the chopsticks one at a time. Discuss how the four necessary conditions for deadlock indeed hold in this setting. Discuss how deadlocks could be avoided by eliminating any one of the four conditions.

OR

(a') Briefly describe the conditions for existence of a deadlock in a system.

(b) Consider the following snapshot of a system:

<table>
<thead>
<tr>
<th>Allocation</th>
<th>Max</th>
<th>Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>A B C D</td>
<td>A B C D</td>
<td>A B C D</td>
</tr>
<tr>
<td>P0 0 0 1 2</td>
<td>0 0 1 2</td>
<td>1 5 2 0</td>
</tr>
<tr>
<td>P1 1 0 0 0</td>
<td>1 7 5 0</td>
<td></td>
</tr>
<tr>
<td>P2 1 3 5 4</td>
<td>2 3 5 6</td>
<td></td>
</tr>
<tr>
<td>P3 0 6 3 2</td>
<td>0 6 5 2</td>
<td></td>
</tr>
<tr>
<td>P4 0 0 1 4</td>
<td>0 6 5 6</td>
<td></td>
</tr>
</tbody>
</table>

Answer the following questions using the banker's algorithm:
(i) What is the content of the matrix Need?
(ii) Is the system in a safe state?
(iii) If a request from P1 arrives for (0, 4, 2, 0), can the request be granted immediately?

4(a) Consider a demand paging system where the average page-fault service time is 8 milliseconds, and the memory access time is 200 nanoseconds. Answer the following questions:
(i) If one access out of 1000 accesses causes a page-fault, what is the effective access time?
(ii) If the performance degradation is to be kept less than 10%, what should be the page-fault rate?

(b) Consider the following reference string:
7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1.

Let there be three frames, compute the number of page-faults in case of the optimal (OPT) page replacement policy.

OR

(b') Let there be 200 cylinders in a disk numbered from 0 to 199. Consider a disk queue with requests for I/O to blocks on cylinders 98, 183, 37, 122, 14, 124, 65, 67, in that order. If the disk head is initially at cylinder 53, what is the total head movement in case of the shortest-seek-time-first (SSTF) algorithm?
Maximum Marks: 60  
Credits: 04  
Duration: Two Hours

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

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>Give the point-wise comparative analysis of DSB-SC, SSB and Amplitude modulation techniques.</td>
<td>[03]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Draw the block diagram of the communication systems and briefly describe the function of each block.</td>
<td>[04]</td>
</tr>
<tr>
<td>1(c)</td>
<td>The signal ( m(t) = 5 \cos(4\pi 10^3 t) ) is applied to a product modulator, together with a carrier ( c(t) = 15 \cos(2\pi f_c t) ), producing the DSB-SC modulated signal ( s(t) ). The modulated signal is next applied to a coherent detector. Assuming perfect synchronism between the carrier waves in the modulator and detector, determine the spectrum of the detector output.</td>
<td>[08]</td>
</tr>
</tbody>
</table>

**OR**

<table>
<thead>
<tr>
<th>Q.No.</th>
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<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(e')</td>
<td>Briefly explain the working of the super heterodyne AM radio receiver with the help of suitable block diagram.</td>
<td>[08]</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2(a)</td>
<td>Describe the working of digital time division multiplexing systems with the help of suitable diagram.</td>
<td>[08]</td>
</tr>
</tbody>
</table>

**OR**

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2(a')</td>
<td>Explain the working of DPCM system.</td>
<td>[08]</td>
</tr>
</tbody>
</table>
| 2(b) | Consider the following sequences of 1s and 0s:  
(a) An alternating sequence of 1s and 0s. | [07] |

*contd... 2.*
(b) A long sequence of 1s followed by long sequence of 0s

(c) 0010111

Sketch the line encoded waveform for each of these sequences using the following methods of representing symbols 1 and 0:

(i) On-off signaling (ii) Bipolar RZ signaling (iii) Split phase (iv) Unipolar RZ signaling

3(a) Derive the expression for the average probability of error of the binary ASK modulation scheme corrupted by additive white Gaussian noise with variance \( \sigma^2 \). Assume that transmission of symbols 1 and 0 are equally likely.

OR

3(a') Determine the average energy of a set of M-ary ASK signals of the form

\[
s_m(t) = s_m \psi(t), \quad m = 1, 2, ..., M
\]

where \( s_m = \sqrt{E_g} A_m, \quad m = 1, 2, ..., M \) and \( \psi(t) \) denotes unit energy basis signal. The signals are equally probable with amplitudes that are symmetric about zero and are uniformly spaced with distance \( d \) between adjacent amplitudes as shown in Figure 1.

\[
\begin{array}{c}
- d - d - d - d - d - d - d - 0 \\
\end{array}
\]

Figure 1

3(b) Discuss the merits and limitation of M-ary ASK, M-ary PSK and M-ary QAM modulation techniques in terms of power efficiency, spectral efficiency and Error performance.

4(a) A source has an alphabet \( \{a_1, a_2, a_3, a_4\} \) with corresponding probabilities \( \{0.1, 0.2, 0.3, 0.4\} \).

i. Find the entropy of the source.

ii. Design a Huffman code for the source and compare the average length of the Huffman code with the entropy of the source.

4(b) Using the generator polynomial \( x^3 + x + 1 \), what is the transmitted code word using cyclic redundancy check code method for the data sequence 11110?

4(c) What are the advantages of spread spectrum techniques?
1a. Explain the law of diminishing return with the help of suitable examples. [05]

OR

a'. Differentiate between consumer and producer goods/services. Why it is more difficult to estimate the demand for producer goods? [05]

b. For purchasing a universal testing machine, two options are available. The cash flow details of two options are presented below:

<table>
<thead>
<tr>
<th></th>
<th>Option-1</th>
<th></th>
<th>Option-2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial purchase price (Rs.)</td>
<td>17,00,000</td>
<td>21,00,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual operating cost (Rs.)</td>
<td>45,000</td>
<td>30,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected salvage value (Rs.)</td>
<td>3,70,000</td>
<td>4,50,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Useful life</td>
<td>6 years</td>
<td>12 years</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Find out the most economical alternative at a interest rate of 9% per year compounded bi-annually. [07]

2. Answer any TWO of the following.

a. Cash flow details of four mutually exclusive alternatives for a public project are presented below:

<table>
<thead>
<tr>
<th>Initial investment(Rs.) (*10^3)</th>
<th>Alt 1</th>
<th>Alt 2</th>
<th>Alt 3</th>
<th>Alt 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>161,500</td>
<td>203,000</td>
<td>146,000</td>
<td>173,500</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual operating &amp; maintenance cost (Rs.) (*10^3)</th>
<th>Alt 1</th>
<th>Alt 2</th>
<th>Alt 3</th>
<th>Alt 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>8,220</td>
<td>7,630</td>
<td>8,640</td>
<td>7,975</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual benefits (Rs.) (*10^3)</th>
<th>Alt 1</th>
<th>Alt 2</th>
<th>Alt 3</th>
<th>Alt 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>22,750</td>
<td>26,500</td>
<td>21,500</td>
<td>23,800</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Useful life (years)</th>
<th>Alt 1</th>
<th>Alt 2</th>
<th>Alt 3</th>
<th>Alt 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>45</td>
<td>45</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

According to you which is the best alternative on the basis of an incremental benefit cost analysis, if interest rate is 8% per year. Why?

cont'd...
b. A construction firm purchased a piece of construction equipment 4 years ago at a cost of Rs.55,00,000. The current market value of the equipment is Rs.37,65,000. The estimated salvage value, annual operating cost and remaining life of the equipment are Rs.8,00,000, Rs.1,40,000 and 9 years respectively. The firm is now considering replacement of the existing equipment with a new model. The initial cost of the new model is Rs.44,00,000. The estimated life and salvage value of the new model are 9 years and Rs.10,70,000 respectively. The annual operating cost is Rs.1,30,000. The construction firm's MARR is 12% per year. By using 9 year study period, determine whether the construction firm should continue with the existing equipment or replace it with the new model.

c. Define "depreciation". Why it is calculated? The initial cost and useful life of an asset are Rs.18,00,000 and 11 years respectively. The estimated salvage value of the asset at the end of useful life is zero. Determine annual depreciation and book value using declining balance method. Find out the year in which the switching from declining balance method to straight-line method takes place.

3a How managers can be differentiated in a typical organization? Explain them through a block diagram.

OR

a' Differentiate between "data" and "information". Enumerate the different characteristics of useful information that a manager generally receives.

b. Explain Delphi and Nominal Group methods of decision making. A company is manufacturing a gate valve, which it sells @ $115 and has a fixed cost equal to $120,000 and variable cost @ $65. Obtain the number of gate valves to be produced to break-even the production.

4 Differentiate between any THREE of the following:
   - Coercive Power and Referent Power
   - Job-centred behaviour and Employee-centred behaviour
   - Tall organizations and Flat Organizations
   - Strategic goals and Tactical goals

OR

4' Define the meaning of "Control" in an organization? What are the fundamental steps that should be followed in implementing controlling process? Explain them by using a flow diagram.
5. Answer any TWO of the following:

a. The Director of a Technical and Management Institute wants to forecast student enrollments for this academic year based on the following historical data:

<table>
<thead>
<tr>
<th>Academic Year (t)</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Demand (D_t)</td>
<td>15,000</td>
<td>16,000</td>
<td>18,000</td>
<td>20,000</td>
<td>21,000</td>
</tr>
</tbody>
</table>

i. What is the forecast for this year using exponential smoothing with $a = 0.4$, if the forecast for three years ago was 16,000?

ii. What are your forecasts using 3-period moving average? Compare the results of the two methods for the year 2016 and give your recommendations.

b. What is "Market"? List the types of markets that are used by sellers and buyers in a modern exchange economy. Discuss any five types of entities that the marketing managers markets to keep their target customers updated.

c. What procedure the human resource managers adopt while planning human resource for any business organization? Explain it through a flow diagram.