Questions bank of embedded system:

Chapter - 1

1. Differentiate between general purpose computing system and embedded system.
2. What is an embedded system? Explain the different applications of embedded systems.
3. What are the common characteristics of embedded system?
4. Prove that, Digital camera is a good example of embedded systems.
5. Classify embedded system based on generation.
6. Classify embedded system based on complexity and performance.
7. Write the major application of embedded system.
8. What are the purpose of develop embedded system?
9. What is non recurring engineering cost? How it role-plays in embedded system?
10. What is an embedded system? Why is it so hard to define? Explain the different types of embedded system. Explain the different applications of ES.
11. List and define the three main characteristics of embedded systems that distinguish such systems from other computing systems.
12. Prove that, Digital Camera is a good example of embedded system.
13. What is a design metric? List out the commonly used design metrics. (069 Poush Back)
14. What is non-recurring engineering cost (NRE cost)? How it plays role in embedded system?
15. List and define the three main processor technologies. What are the benefits of using each of the three different processor technologies?
16. Differentiate between single-purpose processor, general-purpose processor and application specific processor. Using the simplified revenue model, derive the percentage revenue loss equation for any rise angle, rather than just for 45 degrees. (070 Bhadra Regular)
17. What are the common characteristics of embedded systems? Explain. (070 Bhadra Regular)

Chapter - 2

18. How can you optimizesingle purpose processor? State briefly.
19. How can you optimize the original program in single purpose processor? Explain with example.
20. Differentiate between sequential and combinational circuit.
21. How can you optimize the FSMD in single purpose processor? Explain with example.
22. How can you optimize the datapath in single purpose processor? Explain with example.
23. How can you optimize the FSM in single purpose processor? Explain with example.
24. Explain the controller and datapath with example.
25. Describe resister transfor (RT) level single purpose processor design.
26. What is the difference between a synchronous and an asynchronous circuit?
27. Design a single-purpose processor that outputs Fibonacci numbers up to n places. Start with a function computing the desired the result, translate into a state diagram, and sketch a probable datapaath.
28. What is the purpose of the datpath? of the controller?
29. Determine whether the following are synchronous or asynchronous circuit?
30. What is a single-purpose processor? What are the benefits of choosing a single-purpose processor over a general-purpose processor?

31. How do nMOS and pMOS transistors differ?
32. Build a 3-input NAND gate using a minimum number of CMOS transistors.
33. Build a 3-input NOR gate using a minimum number of CMOS transistors.
34. Build a 2-input AND gate using a minimum number of CMOS transistors.
35. Explain why NAND and NOR gates are more common than AND and OR gates.
36. Distinguish between a combinational circuit and a sequential circuit.
37. How can you optimize single purpose processor? State briefly.
38. How can you optimize the datapath in single purpose processor?
39. How can you optimize the FSM in single purpose processor?
40. Describe the resistor transistor (RT) level single purpose processor design.
41. What is the purpose of the datapath ?of the controller?
42. Design a 2-bit comparator (compares two 2-bit words) with a single output "less-than," using the combinational design technique described in the chapter. Start from a truth table, use K-maps to minimize logic, and draw the final circuit.
43. Design a 3-bit counter that counts the following sequence: 1, 2, 4, 5, 7, 1, 2, etc. This counter has an output "odd" whose value is 1 when the current count value is odd. Use the sequential design technique of the chapter. Start from a state diagram, draw the state table, minimize the logic, and draw the final circuit.
44. Four lights are connected to a decoder. Build a circuit that will blink the lights in the following order: 0, 2, 1, 3, 0, 2, ... Start from a state diagram, draw the state table, minimize the logic, and draw the final circuit.
45. Design a single-purpose processor that outputs Fibonacci numbers up to n places. Start with a function computing the desired result, translate it into a state diagram, and sketch a probable datapath.
46. Design a custom single-purpose processor that calculates the factorial of an integer showing the design of data path and block representation of the controller. (069 Poush Back)
47. Design a processor that calculates the LCM of two numbers. Show the design of data path only and construct the diagram of controller. (069 Bhadra Regular)
48. Design a processor that calculates the GCD of two numbers. Show the design of data path and block representation of the controller
49. What is optimization? Explain optimization of single purpose processor in detail with suitable examples. (070 Bhadra Regular)

Chapter - 3

50. Describe the basic structure of processor. Why general purpose software design?
51. Explain the datapath operation with figure.
52. How control unit function in processor?
53. Explain control unit sub operation according to software design aspect.
54. Draw instruction cycles of processors for each step.
55. What are the differences between datapath and control unit? Explain the datapath operation and instruction cycles.
56. What is pipelining? How can you increase instruction throughput?
57. What are the facts in software design programmer considered?
58. What are the software development procedures in software design in embedded systems?

59. How hardware description languages differ than instruction set simulator in simulation? Design ISS for simple processor.
60. How a general purpose processor is differ than application specific instruction set processors (ASIPs)? What are the common features of ASIPs for microcontroller?
61. How a general purpose processor is differ than application specific instruction set processors (ASIPs)? What are the common features of ASIPs for digital signal processors?
62. Design general purpose processor and it architecture of a simple microprocessor.
63. Classify the embedded system based on generation and explain it. How can you optimize the single-purpose processors? Explain optimizing the FSMD.
64. What is ASIPs? Explain common ASIPs.
65. Describe the basic structure of general-purpose processor. Why general purpose software design?
66. Explain the datapath operation in general- purpose processor.
67. How control unit function in processor?
68. Describe the basic stages of execution of instructions of general-purpose processor.
69. Explain the pipelining with suitable example.
70. What are the programmer considerations? Explain the software development processes according to embedded systems. (069 Bhadra Regular)
71. What are the common features of ASIP's for i) microcontroller and ii) digital signal processor?
72. What is the criterion for selecting microprocessor? Elaborate briefly.
73. Describe the testing and debugging stage during software design process.
74. What is ASIP's? Explain common ASIP's.
75. What is the difference between microprocessor and microcontrollers?
76. How performance of existing system can be improved? Explain in brief. (069 Poush Back)

Chapter - 4

77. How SRAM is differ than DRAM. Write DRAM operation.
78. How microcontroller is differing than microprocessor? Compare 8051 families.
79. Classify the embedded system based on complexity and performance requirement.
80. How can you optimize the single-purpose processors? Explain optimizing the original program.
81. What are the programmer considerations in an Embedded Systems?
82. What are the factors to be considered in selecting a controller? Compare 8051 families.
83. Explain the write ability and storage permanence of semiconductor memory.
84. Differentiate between FPM DRAM and EDO DRAM, SDRAM and DDR DRAM.
85. Describe Mask PROM, OTP ROM,PROM, EPROM, EEPROM, Flash Memory.
86. How can you compose memory to increase number and width of words?
87. Briefly define each of the following: mask-programmed ROM, PROM, EPROM, EEPROM, flash EEPROM, RAM, SRAM, DRAM, PSRAM, and NVRAM.
88. Define the two main characteristics of memories as discussed in this chapter. From the types of memory mentioned, list the worst choice for each characteristic. Explain.
89. What are the basic techniques of cache mapping? How direct mapping differ than fully associative mapping? (Hint page 126-127 of Frank Vahid)
90. What are the cache replacement policies?
91. What are the cache write techniques? (069 Bhadra Regular)
92. How cache impact on system performance?

93. How OTP-ROM differs than mask-ROM? Explain read, write and erase techniques for EPROM. (069 Poush Back)
94. Explain the operation of storing and erasing the data in UV-EPROM. (069 Bhadra Regular)
95. Differentiate between SDRAM and ESDRAM
96. Sketch the internal design of a 4 × 3 ROM.
97. Describe ROM and introduce its types in detail. Sketch the internal design of a 4 × 3 RAM. (070 Bhadra Regular)
98. What are basic techniques for cache mapping? How direct mapping differ than fully associative mapping?
99. Explain the set associate cache mapping.
100. What are the cache replacement policies?
101. What are the cache write techniques?
102. How cache impact on system performance?
103. How SDRAM operate?
104. What are the general characteristics of Rambus DRAM? Why it is so popular than others?
105. Differentiate between SDRAM and ESDRAM.

Chapter - 5

106. What is interfacing? Explain with simple bus structures with it timing diagram.
107. What are different characteristics of strobe protocol and Handshake protocol?
108. Differentiate between memory mapped I/O and standard I/O.
109. Draw the timing diagram for a bus protocol that is handshaked, nonaddressed, and transfers 8 bits of data over a 4-bit data bus.
110. Explain the difference between port-based I/O and bus-based I/O.
111. Discuss the advantages and disadvantages of using memory-mapped I/O versus standard I/O.
112. Explain the benefits that an interrupt address table has over fixed and vectored interrupt methods.
113. List the three main transmission mediums described in the chapter. Give two common applications for each.
114. Briefly describe about different advanced communications.
115. Explain arbitration systems implemented to communicate with peripheral device from the microprocessor. Differentiate between memory mapped I/O with standard I/O. (069 Bhadra Regular)
116. Explain the bus-based I/O and port-based I/O with the hardware protocols. (069 Poush Back)
117. Describe the hardware protocol control methods using strobe, handshake and wait signals. (069 Poush Back)
118. Explain the Daisy-chain Arbitration system in brief.
119. Explain different types of arbitration methods used in peripheral devices to gain control of system bus. Describe the significance of I2C serial communication protocol. (070 Bhadra Regular)

Chapter - 6

120. Write a multithreaded application to print “Hello, I am in main thread” from the main thread and “Hello, I am in new thread” five times each, using *pthread_create ( )* and *pthread_join ( )*posix primitives.

121. Write a multithreaded application using Win 32 APIs to set up a counter in the main thread and secondary thread to count from 0 to 10 and print the counts from both the threads. Put a delay of 500 ms in between the successive printing in both the threads.
122. What is Operating System? Describe the functions of OS. (069 Poush)
123. Differentiate between RTOS and GPOS.
124. Define Kernel. What is Real Time Kernel and what are their types?
125. What is a process in OS? Describe the structure and life cycle of a process. (069 Poush)
126. Define threads. Explain the concept of multithreading and why it is necessary?
127. Explain in brief about the different types of thread standards or libraries.
128. What are the different types of threads? Explain it. Discuss the different binding techniques of user level threads to kernel threads.
129. Differentiate between user level thread and kernel level thread. (070 Bhadra)
130. Differentiate between multiprocessing and multitasking. Explain the types of multitasking.
131. Describe the context switching process in detail. (070 Bhadra), (069 Bhadra).
132. What are the factors affecting on selection of scheduling algorithm?
133. What is task scheduling and what are its types? Explain in brief. (069 Poush)
134. What is the condition that favors a deadlock situation? Explain the different deadlock handling mechanism. (070 Bhadra)
135. What is semaphore? What are the types of semaphore?
136. Write short notes on Device Drivers.
137. Three processes with IDs P1, P2, P3 with estimated completion time 10, 5, 7 milliseconds respectively enters the ready queue together in the order P1, P2, P3. Calculate the waiting time and Turn Around Time (TAT) for each process and the average waiting time and TAT (Assuming there is no I/O waiting for the process).
138. Three processes with IDs P1, P2, P3 with estimated completion time 6, 8, 2 milliseconds respectively enters the ready queue together in the order P1, P2, P3. Process P4 with the estimated execution time 4 milliseconds enters the ready queue after 1 millisecond. Calculate the waiting time and Turn Around Time (TAT) for each process and the average waiting time and TAT in the non-preemptive shortest-job-first scheduling. (070 Bhadra)
139. 6.18 Explain the basic function of Real Time Kernel. (069 Bhadra)

Rewrite all program examples and numerical examples from Embedded System book by K.V. Shibu pages 395 to 480.

Chapter - 7

140. Designing the close loop control system. Explain avoid oscillation and prefect tracking.
141. Explain the difference between open-looped and closed-looped control systems. Why are we more concerned with closed-looped systems?
142. List and describe the eight parts of the closed-loop system. Give a real-life example of each
143. Write a generic PID controller in C.
144. What are the benefits of computer based control implementation?
145. What is PID tuning? Discuss on the practical issues related with computer based control. (069 Bhadra Regular)
146. Design a closed-loop automobile cruise controller and derive the conditions for no oscillation and for reduction of the road disturbance. (069 Poush Back). *Hint: see page 251-255 of Frank Vahid*

147. Design a open-loop automobile cruise controller and derive the conditions for reduction of disturbance and determine performance parameters. *Hint: see page248-251 of Frank Vahid*
148. Explain the operation of PID controller with a clean block diagram. (070 Bhadra)
149. Define the terms used in control system: Controller, Plant, Actuator. (070 Bhadra)
150. Designing the close loop control system. Explain stability and prefect tracking.

Chapter - 8

151. What are the steps to do silicon or wafer condition after photolithography in IC fabrication processes?
152. Write importance of photolithography process in IC fabrication technology. Write briefly, each photolithography step during IC fabrication. (069 Bhadra and Poush)
153. Explain the types of IC technology.
154. Differentiate between Full-custom and Semi-custom IC technology.
155. Describe the steps involved in manufacturing an IC. Show the top-down view of the circuit F= xz+y on an IC. (070 Bhadra)
156. What are the steps to do silicon or wafer condition prior to pattern in IC fabrication processes?

Chapter - 9

157. What is the different between microprocessor and microcontroller?
158. What are the factors to be considered in selecting a controller?
159. Why 8051 microcontroller is used? Write an assembly program to get data from P0 and send it to P1 and compare with corresponding C program. (069 Bhadra)
160. List all the special function registers of 8051 and explain functions of each. (069 Poush)
161. Explain the different types of addressing modes used in 8051 microcontrollers.
162. Write a program to display 0-9 in seven segment display.
163. Why the port 0 of 8051 should be pulled up while using it?
164. Show the internal Structure of the 8051 microcontroller. Provide comparison chart of the 8051 microcontroller family members. (070 Bhadra)
165. Explain the Program Status of Word register of 8051 microcontroller.
166. What are the different types of instruction sets used in 8051? Explain in brief with examples.
167. Describe the different purpose of port 3 of 8051.

Chapter - 10

168. Write a program in VHDL for a positive edge triggered D flip-flop.
169. Write a VHDL code to implement Flip flops: JK flip-flop, D-flip flop.
170. Write the VHDL code for processor (GCD) that calculates greatest common divisor of two integer data with its state diagram. (069 Bhadra)
171. Explain elevator's unit control process using a state machine. (069 Poush) *Hint:* see *page 210-212 of Frank Vahid*
172. Write short notes on FPGA.
173. Write the code for BCD counter to display 0 to 9999 in seven segment using VHDL. (070 Bhadra)