BE1-R3: EMBEDDED SYSTEMS

NOTE:

> 1. **Answer question 1 and any FOUR questions from 2 to 7.**
> 2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours **Total Marks: 100**

1.
a) Compute a memory needed in bytes to store a 4 bit digital encoding of a 3 second analog audio signal sampled every 10 milliseconds.
b) Discuss the advantages and disadvantages of using memory-mapped I/O versus standard I/O.
c) What are the differences between the Harvard architecture and von-neumann architecture?
d) What is the difference between latency and throughput? What are three stages in ARM pipeline?
e) Define an Embedded Systems? How does a DSP differ from a general purpose processor (GPP)?
f) Explain, why the person generating clear-box program tests should not be the person who wrote the code being tested.
g) List the functions of a kernel. What can be the functions outside the kernel?

(7x4)

2.
a) Write two 'C' routines that, each take as input two 32-bit fixed point numbers and perform addition and multiplication using 4 bits for the fractional part and the remaining bits for the whole part.
b) What factors provide a lower bound on the period at which the system timer interrupts for preemptive context switching?

(9+9)

3.
a) Provide a user-level example of Static and Dynamic power management.
b) What happens if an interrupt handler executes for too long and the next interrupt occurs before the last call to the handler has finished?
c) Assume an A/D converter is supplying samples at 44.1 kHz.
   i) How much time is available per sample for CPU operations?
   ii) If the interrupt handler executes 100 instructions obtaining the sample and passing it into the application routine, how many instructions can be executed on a 20 MHz RISC processor that executes 1 instruction per cycle?

(6+4+8)

4.
a) Why are device-driver routines important in system? Compare device servicing without using the ISR and with device-driver ISR?
b) Explain interpreters and JIT compilers. How can program performance be measured?

(9+9)

5.
a) Define a critical section of a Task. How is data (Shared Variables) shielded in Critical section of a process before operated and changed by another higher priority process that starts execution before the process finishes?
b) List the features of P and V semaphores and explain, how these are used as resource key, as a counting semaphore and as a mutex.

(9+9)

6.
a) What are the advantages of a Distributed system? Explain operation of I^2C interface.
b) Write brief note on SHARC link ports and explain, how network delay will be improved by adjusting messages.

(9+9)

7.
a) Compare and contrast the IrDA and Bluetooth wireless protocols.
b) Explain the J2ME and Jini architecture.
c) Briefly describe the differences between the waterfall and spiral development models.

(6+6+6)