CSPC61 – Embedded Systems Architecture
VI Semester - Section A / Cycle Test II

Time : 1 Hour

Answer ALL Questions

Max. Marks : 20
Date: 01/04/2025

1. Given the following periodic tasks: (2)

    - Task A: Period = 4, Execution Time = 1
    - Task B: Period = 6, Execution Time = 2
    - Task C: Period = 12, Execution Time = 4

    (a) Calculate the total processor utilization. Is this task set schedulable under EDF?
    (b) Draw the EDF schedule for the first hyperperiod (LCM of periods).

2. Tasks share resource R under EDF + PCP: (3)

    - T1T1: P=6, C=2 (uses R for 1 unit at t=1)
    - T2T2: P=9, C=3 (uses R for 2 units at t=2)

    (a) Simulate until t=9. Does priority inversion occur?
    (b) What is the worst-case blocking time for T1?

3. Tasks share resource R under EDF + PCP: explain (Power consumption of an Embedded System) ?   (3)

    - T1T1: P=6, C=2 (uses R for 1 unit at t=1)
    - T2T2: P=9, C=3 (uses R for 2 units at t=2)

    (a) Simulate until t=9. Does priority inversion occur?
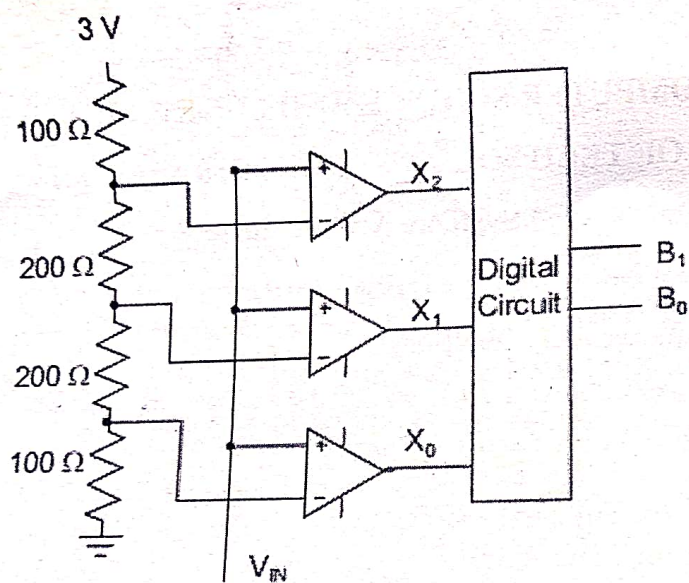   (b) What is the worst-case blocking time for T1?

4. A microcontroller operates at 1.8 V and has an average switching capacitance of 10 nF. The clock frequency is 50 MHz, and 30% of the gates switch per clock cycle.   (2)

    (a) Calculate the dynamic power consumption.
    (b) If the voltage is reduced to 1.2 V, how does power change?

5. A 5-bit DAC has a reference voltage (V_{ref}) of 8 V.   (4)

    (a) Calculate the voltage resolution (LSB size).
    (b) Determine the analog output for the digital input 10110.

6. A 2-bit flash Analog to Digital Converter (ADC) is given below. The input is $0 \leq VIN \leq 3$ Volts. The expression for the LSB of the output B0 as a Boolean function of X2,X1 and X0 is?   (4)

3 V

100 Ω

200 Ω

200 Ω

100 Ω

X_2

X_1

X_0

V_{IN}

Digital Circuit

B_1

B_0

7.   A temperature in the range of -40°C to 55°C is to be measured with a resolution of 0.1°C. The minimum number of ADC bits required to get a matching dynamic range of the temperature sensor is___?   (2)