1. a) Find the transfer function, \( H(s) = \frac{X_o(s)}{X_i(s)} \), for the above system.

b) If \( G = 10 \), for what values of \( K \) is the system stable? (Consider positive and negative values of \( K \).)

2. a) For the circuit shown below, find the simplest possible Boolean expression for \( F \) in terms of \( A \) and \( B \). The simplest answer has the minimum total number of ANDS, ORS, and NOTS (inverters).

b) Find the simplest Sum-Of-Products (SOP) form for the following Boolean expression:
\[ (A + B)(A + B)C \]

c) Show the minimum logic circuit (using logic gates and a Flip-Flop) that has the following timing diagram. CLK, A, and B are inputs, and F is the output. You may use AND, OR, EX-OR, and NOT (inverter) gates. The optimal design has the minimum total number of gate inputs.
3. a) Find the sum of the following hexadecimal numbers and express the answer in binary and Binary Coded Decimal (BCD).

A3 + 7F

b) Find the product of the following binary numbers and express the answer in octal.

101011 · 011001

c) A Flip-Flop circuit, truth table, and timing diagram are shown below. Fill in the missing waveform for Q in the timing diagram.

Find the numerical value of the equivalent impedance, $z_{eq}$, for the circuit. Frequency $\omega = 1$ Mr/s. Express your answer in both rectangular and polar form.