1 Digital Electronics (ijw24)

(a) Show that the Boolean function $F$ can be represented as the exclusive OR operation of two terms, where each term comprises the AND operation of 2 variables appearing in either complemented or uncomplemented form.

$$F(X, Y, Z) = X.Y \oplus X.Z + Y.Z$$

[5 marks]

(b) Consider the Boolean function

$$G(A, B, C, D) = (A + B + C + D).(A + B + C + D).\overline{(A + B + C + D)}.$$

(i) Write down the minterms of $G$ using decimal notation, where $A$ represents the most-significant bit of the equivalent binary representation. [3 marks]

(ii) Simplify $G$ into sum of products form using the Quine-McCluskey (Q-M) method. [7 marks]

(c) Briefly explain the operation of the following circuit and determine the Boolean function that relates the input variables, $A$ and $B$, to the output $Z$? Assume that complemented input variables are available for use.

[5 marks]