C501: Computer Architecture
Assessed Coursework

Due date: **15th November 2017**
(Hard-copy to SAO by 16:00)

1. **Boolean Algebra and Digital Circuits**

   (a) Simplify the following Boolean expressions to its simplest form. The symbols $\bullet$, $+$, and $'$ represent "AND", "OR" and "NOT" operations respectively. Please show the sequence of steps and state the reduction rules used.

   (i) $E = A \bullet B + B \bullet (A' + A \bullet B)$ (5 marks)

   (ii) $E = (A + B)' \bullet (C + D + F)' + (A' \bullet B')$ (10 marks)

   (b) Use Boolean Algebra to simplify the following expression and then draw the logic circuit for the simplified expression. $E = A \bullet (B + A \bullet B) + A \bullet C$ (10 marks)

   (c) NOR gates as well as NAND gates are considered as universal gates. Build a circuit for the following Boolean expression $E = A \bullet B$ using only NOR gates. Prove that your circuit works, either by using truth tables or Boolean Algebra reduction rules. (15 marks)

2. **Binary Arithmetic**

   Show your working clearly.

   (a) Assume that you use 5-bits to represent a number. Using 2's complement representation for numbers, show the calculations of:

   (i) 9 - 11. (5 marks)

   (ii) -12 - 10. (10 marks)

   (b) Evaluate $\frac{189}{27}$ using Binary Arithmetic. (15 marks)

3. **Floating Point Numbers**

   Show your working clearly.

   (a) Convert the decimal number, -31.1 into IEEE Single Precision format and its corresponding hexadecimal value. (15 marks)

   (b) Using the IEEE Single Precision format, convert the following hexadecimal number, 40F109D5 into binary and decimal. (15 marks)