



RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Applied Sciences
Third Year – Semester I Examination – June/July 2018

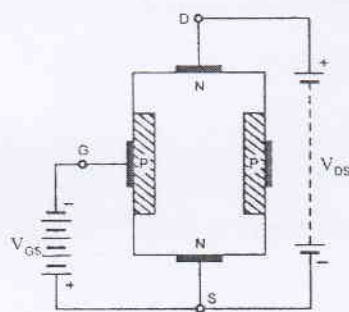
PHY 3212 –ELECTRONICS II

Time: Two (02) hours

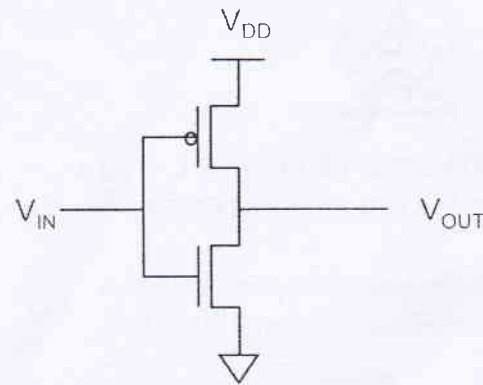
Answer **All** Questions.

Use page number 6 to answer the question numbers 4 (b) (ii), 4 (c) (i) and 4 (e).

1. Following diagram shows an n – channel Junction Field Effect Transistor (JFET) with proper biasing.



- a)
- Plot the Drain current (I_D) as a function of Drain – Source voltage (V_{DS}) for voltages smaller than the Pinch off voltage (V_P) when $V_{GS} = 0$. **(20 Marks)**
 - Draw the shape of the depletion layer when $V_{DS} = V_P$. **(20 Marks)**
 - What happens to the drain current I_D when $V_{DS} > V_P$. **(10 Marks)**
- b)
- What is the advantage of having high input impedance at Gate terminal of a MOSFET? **(10 Marks)**
 - Using appropriate circuit diagrams show the operation of NMOS and PMOS logic switches. **(20 Marks)**
 - Following diagram shows a CMOS logic circuit. Using a simple switching circuit explain the operation of the circuit when V_{IN} is HIGH and LOW. **(20 Marks)**



2. The binary number system and digital codes are fundamental to the modern computer systems and digital electronics.

a) Find the 1's complement and the 2's complement of the following binary numbers.

i. 10110010

ii. 11001101

(10 Marks)

b) Represent the following decimal numbers as an 8 – bit signed binary number using sign-magnitude form

i. +20

ii. – 31

(20 Marks)

c) Represent the following decimal numbers as an 8 – bit number in 1's complement and 2's complement forms.

i. – 19

ii. +19

(20 Marks)

d) Determine the decimal values of the signed binary numbers expressed in 1's complement and 2's complement forms.

i. 00010111

ii. 11101000

(20 Marks)

e) Convert the following binary numbers to gray code .

i. 11000110

ii. 10110011

(20 Marks)

f) Provide an advantage of using gray code over binary code to represent data.

(10 Marks)

3. A car alarm system has following inputs.

- Door (A)
- Key (B)
- Head Lights (C)

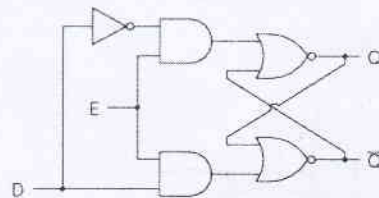
The alarm should sound if the,

- door closed, key out and head lights on.
- door open, key out and head lights on.
- door open, key in and head lights off.
- door open, key in and head lights on.

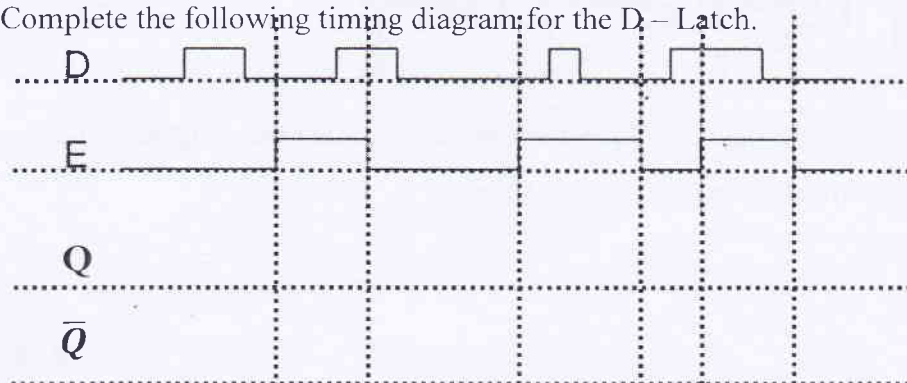
- Construct a truth table for above system. **(25 Marks)**
- Obtain the sum of product expression from the truth table **(25 Marks)**
- Construct a K – Map and obtain a Boolean expression. **(25 Marks)**
- Draw the logic circuit diagram for the Boolean expression obtained in part c. **(25 Marks)**

4. Latches and Flip-Flops are used in modern electronics as temporary storage devices.

- Draw a circuit diagram of a SR latch using NOR gates and explain the truth table. **(20 Marks)**
- Following diagram shows a gated D – latch.



- Develop the truth table for the above D – Latch **(10 Marks)**
- Complete the following timing diagram for the D – Latch. **(10 Marks)**

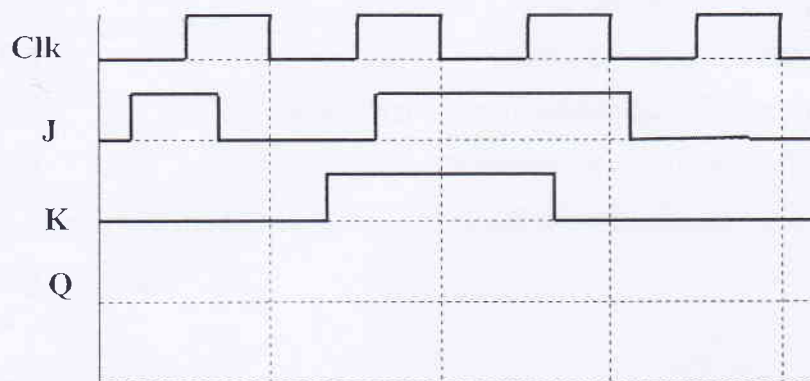


c) Following is a truth table of a positive edge triggered J-K flip - flop.

J	K	CLK	Q	\bar{Q}	Comment
0	0	↑	Q	\bar{Q}	Latch
1	0	↑	1	0	SET
0	1	↑	0	1	RESET
1	1	↑	\bar{Q}	Q	TOGGLE
X	X	Any Thing Else	Q	\bar{Q}	NO Change !

i. Draw the Q output, assuming that the flip-flop is initially RESET.

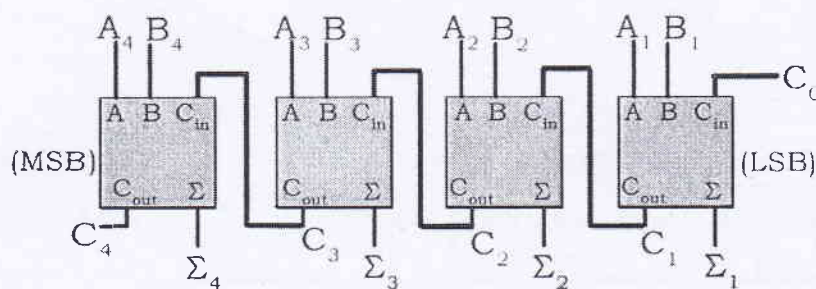
(10 Marks)



ii. What is the main difference between a latch and a flip - flop?

(10 Marks)

d) Following diagram shows a 4 – bit parallel adder.



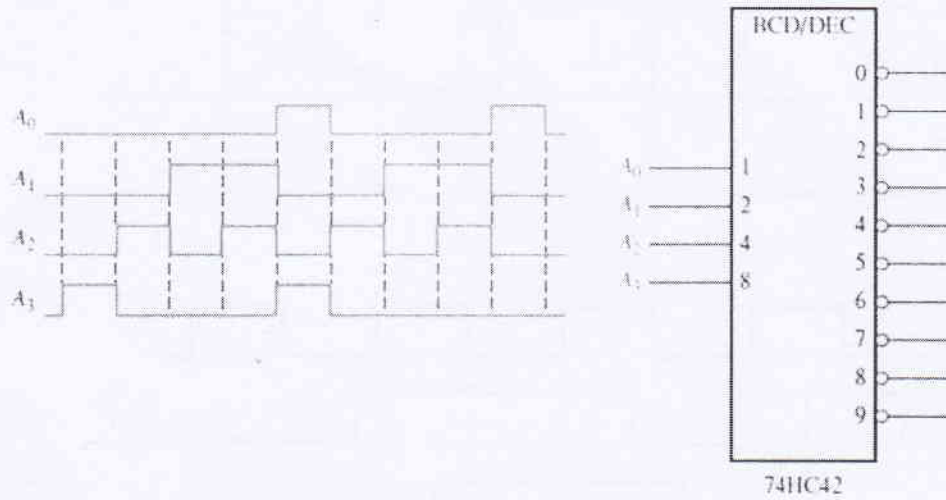
Using above adder, find the sum (Σ) and output carry (C) for the addition of the following 4-bit numbers if the input carry $C_0 = 0$.

i. 1100 + 1100

ii. 1011 + 1101

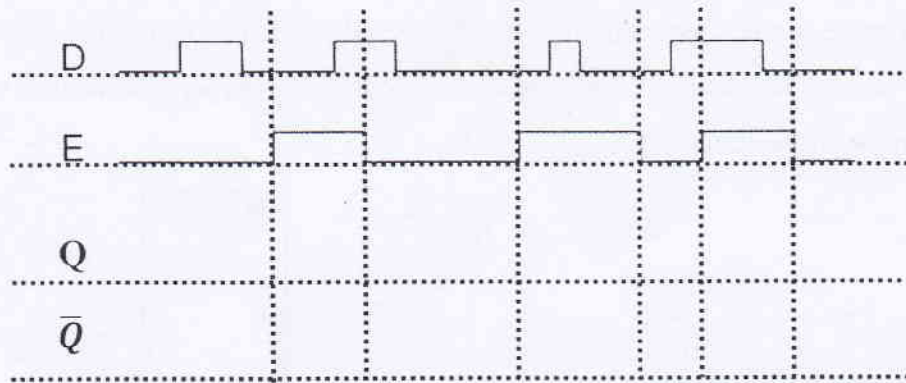
(20 Marks)

e) BCD numbers are applied sequentially to the BCD to decimal decoder in the following figure. Draw the timing diagram, showing each output in the proper relationship with the others and with the inputs.

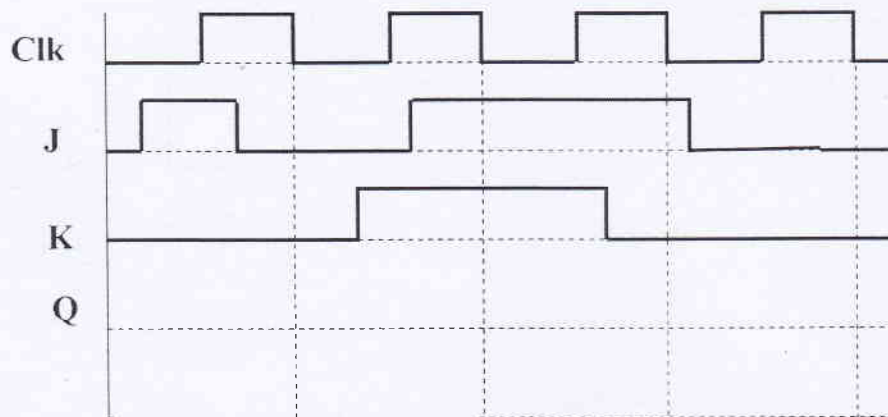


(20 Marks)

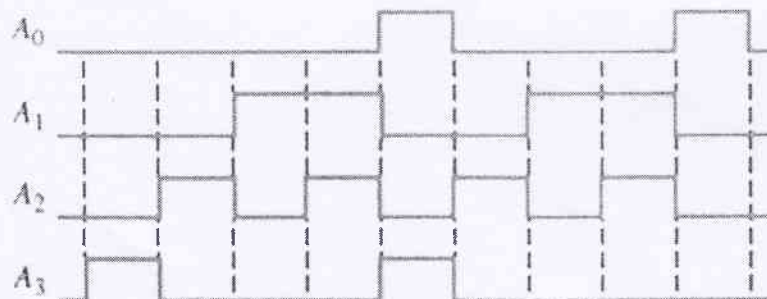
4 (b) (ii)



4 (c) (i)



4 (e)



- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9