201

UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Second Year Examination – Semester II – 2019

SCS2213 – Electronic and Physical Computing - (Part A)

TWO (2) HOURS (For both parts A & B)

To be completed by the candidate

Examination Index No: .....

Important Instructions to candidates:

1. The medium of instruction and question is **English**.
2. **Write your answers** in **English.**
3. If a page or a part of this question paper is not printed, please inform the supervisor immediately.
4. Note that questions appear on both sides of the paper. If a page is not printed, please inform the supervisor immediately.
5. Write your index number on each and every page of the Question paper.
6. This paper has **02** questions and **10** pages.
7. Answer **ALL** questions. All questions carry equal marks (25 marks).
8. **This paper consists of two parts, Part A (Question No 1 and Question No 2) and Part B (Question No 3 and Question No 4) and submit separately.**
9. Any electronic device capable of storing and retrieving text including electronic dictionaries and mobile phones are **not allowed**.
10. **Non-Programmable** calculators are **allowed**.

For Examiner's use only	
Question No	**Marks**
1	
2	
Total	

Index No: .....

Part A

Question 1

(a) Select the most suitable answer from the following list of names (options A to F) for the questions in the table.

A	James Prescott Joule	D	André-Marie Ampère
B	Alessandro Volta	E	Benjamin Franklin
C	Lee De Forest	F	William Shockley

[2 Marks]

Question	Answer (A..F?)
Who discovered the mathematical relationship between voltage, current, and power?	.....
Who discovered the first amplifying device, i.e. triode?	.....
Who discovered the principle of a battery?	.....
Who discovered the mathematical relationship between electricity and electromagnetism?	.....

(b) Consider the following resistor color code,

0 – Black	4 – Yellow	8 – Gray
1 – Brown	5 – Green	9 – White
2 – Red	6 – Blue	Gold: ±5 or 10^{-1}
3 – Orange	7 – Violet	Silver: ±10 or 10^{-2}

(i) Determine the value and tolerance of the following resistor color bands.

[4 Marks]

Color Band	Answer	Color Band	Answer
Yellow-Violet-Brown-Gold	.....	Brown-Black-Black-Silver	.....
Brown-Green-Red-Gold	.....	Brown-Black-Gold-Gold	.....

Index No: .....

(ii) Determine the color bands for the following resistor values.

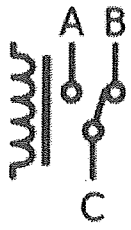
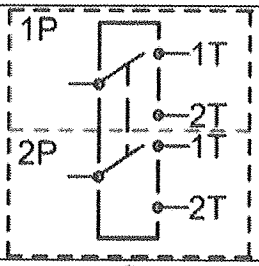
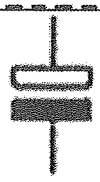
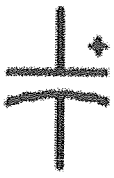
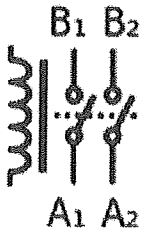
[4 Marks]

Resistor Value	Answer	Resistor Value	Answer
240kΩ ±5%	.....	7.2MΩ ±10%	.....
82Ω ±10%	.....	10Ω ±5%	.....

(c) Select the most suitable answer from the following list (options A to H) for the electronic symbols in the table.

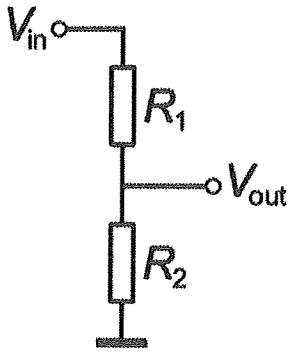
A	DPST Switch	E	DPST Type Relay
B	SPDT Type Relay	F	Polarized Capacitor
C	Variable Resistor	G	DPDT Switch
D	Ceramic Capacitor	H	Light Dependent Resistor

[3 Marks]

Symbol	Answer (A..H?)	Symbol	Answer (A..H?)
	.....		.....
	.....		.....
	.....		.....

Index No: .....

(d) Consider the following voltage divider circuit.



(i) What is V_{out} in terms of V_{in}, R1, and R2? Justify your answer.

[2 Marks]

Answer:

V_{out} =

Calculations:

(ii) Considering that an LED is connected from V_{out} to ground, calculate the resistance and power requirement of R1 when V_{in} = 12V and R2 = 1kΩ. Justify your answer. Note: make sure to maintain 2V across the LED and 18mA of current through it.

[4 Marks]

Answer:

Resistance of R1 (Ohms) =

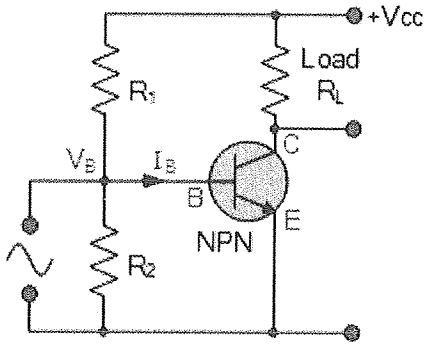
Power requirement of R1 (Watts) =

Cont....

Index No: .....

Calculations:

(e) Consider the following basic common emitter amplifier circuit which uses a voltage divider circuit to bias the transistor base. The biased current (I_B) is only 10% of the current flowing through the biasing resistor R2.



The circuit has the following characteristics.

$$\beta = 100,\ Vcc = 30V,\ \text{and}\ RL = 1k\Omega$$

(i) Determine the current flowing through R2 when the collector current is 1mA? Justify your answer.

[2 Marks]

Answer:

Current through R2 (mA) =

Calculations:

Cont....

(ii) Determine the values for the resistors R1 and R2 when the collector current is 1mA and $V_B = 0.7V$? Justify your answer.

[4 Marks]

Answer:

Resistance of R1 (Ohms) =

Resistance of R2 (Ohms) =

Calculations:

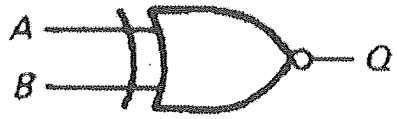
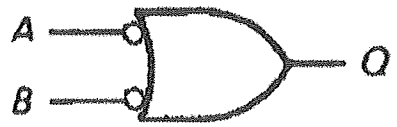
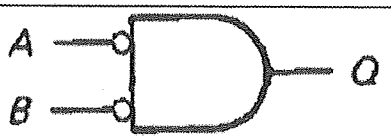
Index No: .....

Question 2

(a) Select the corresponding output behavior for the given gates from the following truth table (options Q1 to Q4).

Inputs		Outputs			
A	B	Q1	Q2	Q3	Q4
0	0	1	1	0	1
0	1	0	0	1	1
1	0	0	0	1	1
1	1	0	1	0	0

[4 Marks]

Logic Gate	Answer (Q1..Q4?)	Logic Gate	Answer (Q1..Q4?)
	.....		.....
	.....		.....

(b) Select the corresponding combinational logic from the following table (options A to H) for the Boolean expressions.

A	4-to-1 Multiplexer	E	Carry-Out of 1-bit Full Adder
B	2-to-1 Multiplexer	F	Carry-In of Full Adder
C	Sum of 1-bit Full Adder	G	Carry-Out of 1-bit Half Adder
D	Sum of 2-bit Half Adder	H	2-bit Decoder

[4 Marks]

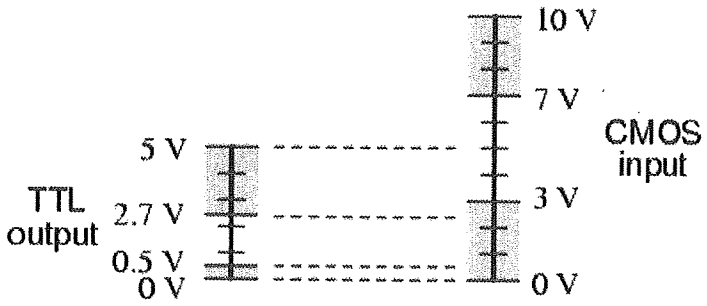
Boolean Expression	Answer (A..H?)
$Q = A\ XOR\ B\ XOR\ C$	.....
$Q = \overline{a}\overline{b}A + a\overline{b}B + \overline{a}bC + abD$	.....
$Q = A.B + C(A\ XOR\ B)$	.....
$Q = A.B$	.....

(c) Show how to use a two input XOR gate as an inverter.

[3 Marks]

Answer:

(d) The following figure shows the problem of the TTL high signal does not fall within the CMOS gate's acceptable limits.



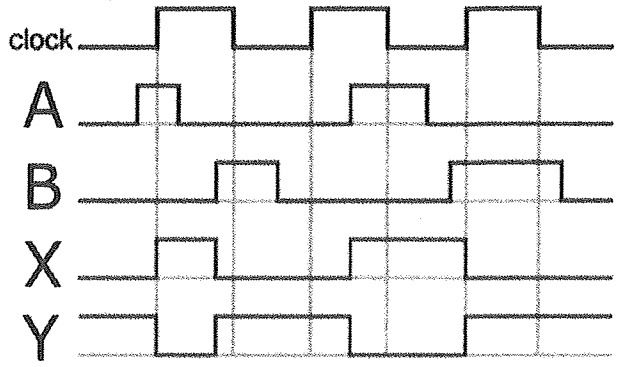
Propose a simple solution to overcome the above problem.

[4 Marks]

Answer:

Index No: .....

(e) Consider the following timing diagram of a sequential logic circuit having three inputs (clock, A, and B) and two outputs (X and Y).



Give the simplified logic diagram of the above sequential logic circuit.

[5 Marks]

Answer:

(f) How would you improve the standard SR flip-flop to avoid the invalid state, i.e. S=R=0? Give the logic diagram implemented only by using NAND gates.

[5 Marks]

Answer:

*** End of Part A ***