



COLLEGE OF ENGINEERING, SCIENCE AND TECHNOLOGY  
SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING

TRADE/DIPLOMA in ELECTRICAL ENGINEERING  
PROGRAMME

EEE437 INTRODUCTION TO ELECTRONICS

**FINAL EXAMINATION (SEMESTER 1, 2018)**

DATE/TIME/ROOM – Refer to Exam Timetable

**INSTRUCTIONS TO CANDIDATES**

1. You are allowed 10 minutes extra time during which you are not to write.
2. Write all your answers in the allocated Answer Booklet.
3. Begin each answer on a fresh new page and use both sides of the sheets.
4. Write your identification number on the top of each attached sheet.
5. Insert all written foolscaps, graph paper, drawing paper, etc in their correct sequence and secure with string provided.
6. For all sheets of paper in which has been done, cross it through and you must attach to your answer script.
7. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
8. Numbering conversion systems calculators are prohibited.
9. All Sections are compulsory.

## **Section A: MULTIPLE CHOICE**

**(25 marks = 1 mark for each correct answer)**

### **Instructions:**

*Write the corresponding question number for the correct alphabet in your answer booklet.*

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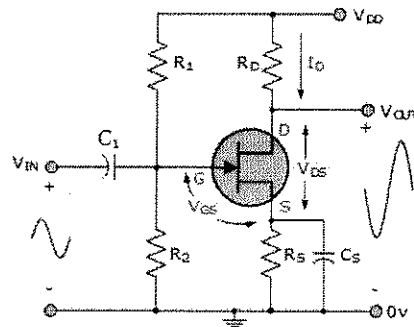
1. Digital Electronics uses quantified values in electronic equipment which is(are) best described as:
- a) Discrete values.
  - b) Continuous values.
  - c) Any quantity varying with time.
  - d) Both c) and d).

(1 mark)

2. The power diode has:
- a) Three p-n junctions.
  - b) One p-n junction.
  - c) Two p-n junctions.
  - d) Four p-n junctions.

(1 mark)

3. Choose the active component used in the circuit diagram below:



- a) Field Effect Transistor.
- b) Resistor.
- c) Capacitor.
- d) Terminal.

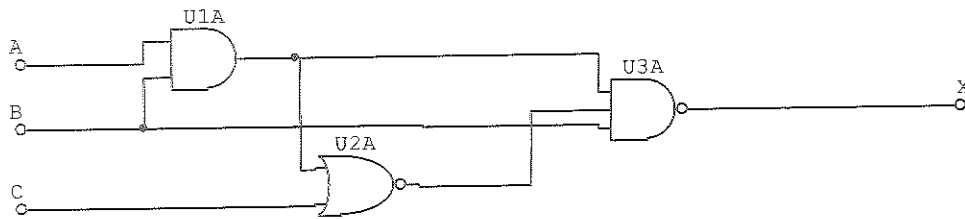
(1 mark)

4. Evaluate the appropriate flipflop which will perform the tasks to prevent debouncing:

- a) SR NOR flipflop.
- b) D flipflop.
- c) JK flipflop.
- d) SR NAND flipflop.

(1 mark)

5. Which Boolean Equation best describes the operation of the combinational logic diagram shown below:



- a)  $X = (AB)(\overline{AB + C})B$
- b)  $X = \overline{(AB)(\overline{AB + C})B}$
- c)  $X = \overline{\overline{(AB)(\overline{AB + C})B}}$
- d) All of the above.

(1 mark)

6. Name the semiconductor component that is used in the rectification stage of the DC power supply unit:

- a) Transistor
- b) Field effect transistor
- c) Light emitting diode
- d) Power diode

(1 mark)

7. Identify the “real world” electronic device:

- a) DAC
- b) ADC
- c) BCD Decoder
- d) Binary Comparator

(1 mark)

8. What is the operating voltage for a TTL IC?

- a) 3V
- b) 18V
- c) 12V
- d) 5V

(1 mark)

9. D and JK flipflops are commonly found in:

- a) Counter circuits.
- b) Register circuits
- c) Debounced circuits
- d) Both a) and b)

(1 mark)

10. In the DC power supply; the rectification stage is to:

- a) Convert AC to AC.
- b) Convert DC to AC.
- c) Convert DC to DC.
- d) Convert AC to DC.

(1 mark)

11. The Boolean theorem known as De-Morgan's theorem  $\overline{A + B}$  is equivalent to:

- a)  $\bar{A} + B$
- b)  $\bar{A} + \bar{B}$
- c)  $\bar{A} \cdot B$
- d)  $\bar{A} \cdot \bar{B}$

(1 mark)

12. The negative (-) input on a uA741 operational amplifier IC is used for:

- a) Non-inverting input
- b) Inverting input
- c) Ground potential
- d) Return path for the current flow

(1 mark)

13. When the J and K inputs are logic 0, the outputs condition will:

- a) Memorize the previous states.
- b) Toggle.
- c) Set.
- d) Reset.

(1 mark)

14. The low pass filter is found in which stage of the DC power supply?

- a) Rectifier.
- b) Regulator.
- c) Filter.
- d) Transformer.

(1 mark)

15. A MINTERM in a Boolean equation represents a:

- a) Logic 0
- b) Logic 1
- c) Logic 2
- d) None of the above

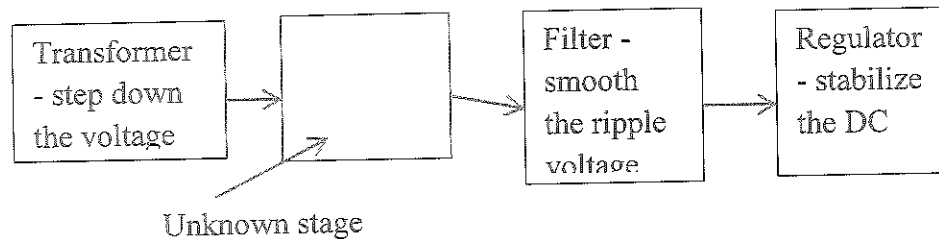
(1 mark)

16. The equivalent binary numbering system of 1101 is equal to:

- a) 13 in decimal numbering system.
- b) D in hexadecimal numbering system.
- c) 15 in octal numbering system
- d) All of the above.

(1 mark)

17. Determine the appropriate circuitry that will best fit the process stage of the given block diagram of the DC power supply system:



- a) Inverter
- b) Converter
- c) Rectifier
- d) None of the above

(1 mark)

18. How many light emitting diodes are found in the seven-segment display?

- a) 7
- b) 14
- c) 8
- d) 9

(1 mark)

19. Identify the appropriate flipflop which will result in the Toggle flipflop:

- a) SR flipflop
- b) D Flipflop
- c) JK flipflop
- d) None of the above

(1 mark)

20. Which electronic device or equipment that is used for telecommunication systems will you find the DAC and ADC circuits?

- a) Router
- b) MODEM
- c) Mouse
- d) Both a) and b)

(1 mark)

21. If the headroom for a fixed negative voltage regulator integrated circuit (IC) is 2 to 3V; then what is the IC specifications if the  $V_{OUT}$  is equal to a nominal value of 12V?

- a) 7912
- b) 7812
- c) 792312
- d) 782312

(1 mark)

22. Which DC power supply system is found in all smart-phone recharger?

- a) Regulated DC power supply system
- b) Stabilized DC power supply system
- c) Unregulated DC power supply system
- d) Both a) and b)

(1 mark)

23. Identify the invalid numbers of an octal numbering system

- a) 8
- b) 9
- c) 8 & 9
- d) None of the above

(1 mark)

24. How many power diodes are found in a full wave bridge rectifier?

- a) 2
- b) 1
- c) 4
- d) 3

(1 mark)

25. Which flipflop does *NOT* have an invalid state?

- a) SR flipflop
- b) D flipflop
- c) JK flipflop
- d) Both a) and b)

(1 mark)

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## **Section B: Application questions**

**(45 marks)**

### **Instructions:**

*Write the appropriate answers in your answer booklet.*

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The Manager Engineering has given you a task to design a system for the Renewable Energy Sustainability Control Management to contain and sustain the availability and energy efficiency to maintain a constant voltage level to power the systems of a 12-star resort. In your design, renewable energy generation was identified as a suitable answer to the mains source. This redundancy plan was to use a pico-hydro, wind turbines, and solar. You are to use 4 voltage sensors to control the switching circuit so that you establish and maintain the voltage levels.

1. Determine this minimized combinational logic circuit by using NOR gates.  
(Include some assumptions, conditions, analysis and process flow to satisfy the design objectives)  

(25 marks)
2. The output of the NOR gates as in question 1) must drive a switching analogue electronic circuit to switch the AC motor for the cooling system in the resort.
  - i. Determine the adjoining analogue electronic block diagram of this switching system.  

(4 marks)

- ii. Apply by illustrating the circuit diagram of this transistor switching system. (Assume  $h_{fe} = 200$ ;  $V_{cc} = 24V$ ;  $I_b = 20 \mu A$ ; & digital gates used are TTL IC. Show the working for the calculation for the value for  $I_c$  and  $R_b$ )

(8 marks)

3. The digital electronic system uses  $+5V_{d.c}$  and the analogue electronic system uses  $+24V_{d.c}$ ; design and draw a circuit diagram of the power supply to facilitate and maintain the voltages to these systems. (Include all analysis)

(8 marks)

### **Section C: Digital and analogue electronics circuits**

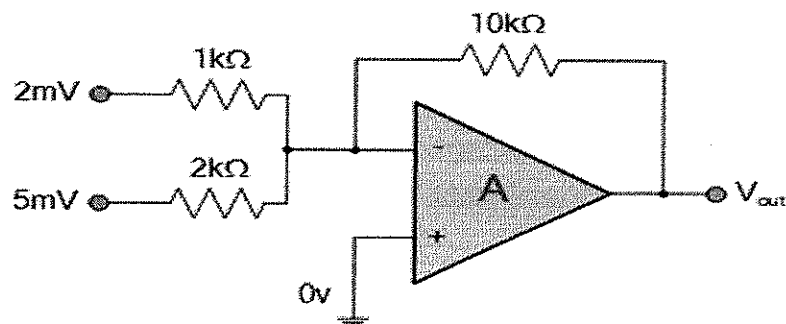
(30 marks)

#### **Instructions:**

- Ensure that your answers in your answer booklet appear in a logical numbering pattern than being too scattered.

1. Evaluate the design of the summing amplifier by calculating the following parameters:

- i. The gain at the input voltage of 2 mV and 5 mV.



(1.5 marks)

- ii.  $V_{out}$  if the given circuit is:

(3.5 marks)



2. Illustrate the representation of ladder logic in relations to the given Boolean equations:

a)  $Y = \bar{A}B + \bar{B}A$  (2 marks)

b)  $Y = B.C$  (2 marks)

c)  $Y = B + A$  (2 marks)

3. Evaluate the conversion equivalent of the given numbering systems by showing all workings:

$2FA_{16} = \text{_____}_8 = \text{_____}_{10} = \text{_____}_2$  (6 marks)

4. An NPN transistor has a DC current gain, ( $\beta$ ) value of 200. Calculate the base current  $I_B$  required to switch a resistive load of 4 mA. (2 marks)

5. Assuming a single-phase bridge rectifier has an AC secondary voltage of 45V at 50Hz, and a load resistance of 1000  $\Omega$ , determine the following parameters:

a) Load voltage,  $V_L$  (3 marks)

b) Load current,  $I_L$  (2 marks)

c) The PIV across the diode, PIV (2 marks)

d) The ripple voltage,  $V_{\text{Ripple}}$  (2 marks)

e) Ripple frequency,  $f_r$  (2 marks)

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