

COLLEGE OF ENGINEERING, SCIENCE AND TECHNOLOGY

School of Electrical & Electronics Engineering

Bachelor of Engineering (Electrical & Electronics/ Mechanical/ Building & Civil)

BEN506 – Introduction to Electrical & Electronics Engineering

SUPPLEMENTARY EXAMINATION

Penster 1, 2017

Date: As per Exam Time Table

Time: As per Exam Time Table (3 hours)

Venue: As per Exam Timetable

Instructions to Students

1. You are allowed an extra ten (10) minutes of reading time during which you are NOT allowed to write.
2. Attempt ALL questions in this examination booklet
3. Write your answers in the answer booklet provided.
4. Write your Student ID number on each page used.
5. Begin each Section on a fresh page and use both sides of the answer sheet.
6. You may use calculators provided they are non-programmable.
7. Clearly number the questions in your answer paper in their correct sequence and write legibly. Show all working.
8. Attach any extra sheets used to your answer booklet securely with the string provided.

Section A: Short Answers [29 marks]

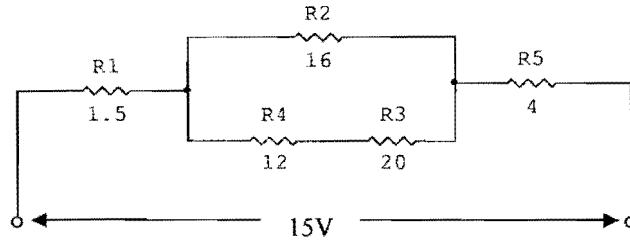
- 1) With the aid of diagrams, explain the terms digital and analog electronic systems. [3 marks]
- 2) Draw the symbol of a 2-input Exclusive OR (XOR) gate and show its truth table. [4 marks]
- 3) State ohm's law. [2 marks]
- 4) Show the truth table of a 2 input NAND gate. [2 marks]
- 5) State two characteristics of an ideal op-amp. [2 marks]
- 6) A current of 0.73A flows for 8 hours through a 138Ω resistor. Calculate the energy consumed (in kWh) by the resistor. [2 marks]
- 7) Convert decimal number 27 to binary using repeated division method. [3 marks]
- 8) Using Boolean algebra techniques and DeMorgan's theorems, simplify the expression:
$$AB + (\bar{A} + \bar{B})C + AB$$
 [4 marks]
- 9) Convert decimal number 49 to Octal. [3 marks]
- 10) Draw the circuit diagram of an inverting amplifier. [2 marks]
- 11) State Kirchhoff's voltage law (KVL) and Kirchhoff's current law (KCL). [3 marks]

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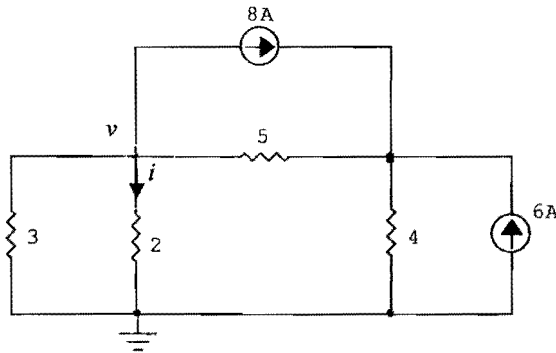
Section B: Concepts and Calculations [71 marks]

Question 1: Circuit Analysis [30 marks]

- a) For the circuit given below, determine the power dissipated by R4 (All resistances are given in ohms). [5 marks]

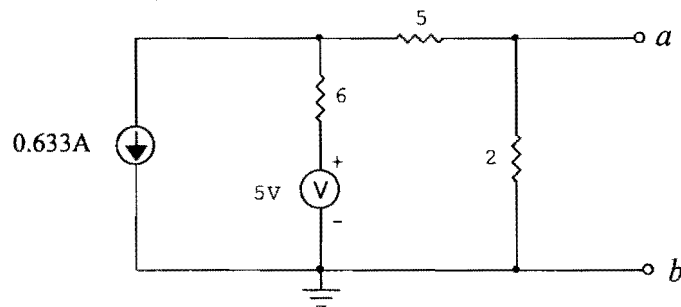


- b) Use nodal analysis to find the voltage v and current i in the circuit shown below (all resistances are given in ohms). [8 marks]



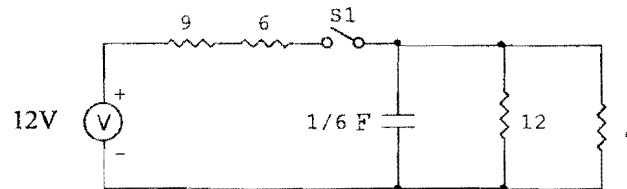
- c) For the circuit given below

- i) Find the Thevenin's equivalent circuit at terminals a-b. [7 marks]
- ii) Determine the power dissipated by the load resistor $R_L = 0.017 \text{ k}\Omega$ connected across terminals a and b. [2 marks]



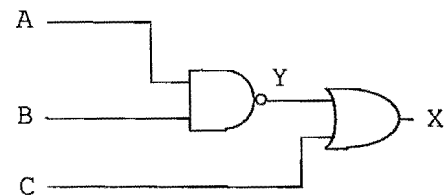
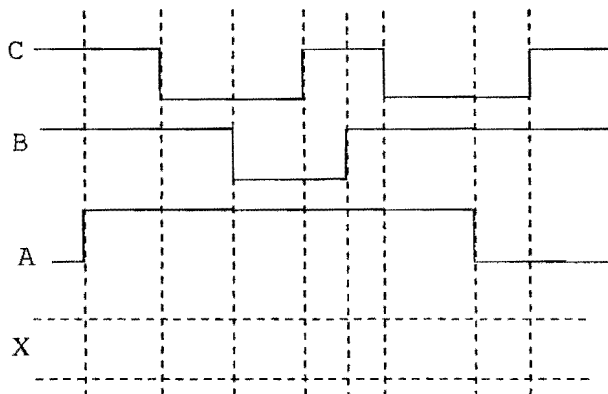
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- d) The switch in the circuit has been closed for a long time, and it is opened at $t = 0$.
- Calculate the initial energy stored in the capacitor. [3 marks]
 - Find the voltage across the capacitor at $t = 1.32\text{s}$. [5 marks]



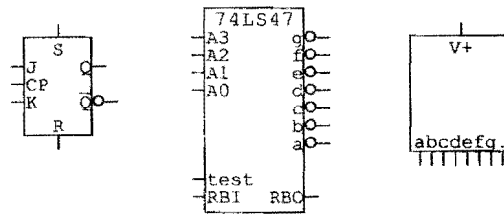
Question 2: Digital Electronics [35 marks]

- Realize the Boolean function $f(A,B,C) = \sum_m(0,2,4,7)$. Formulate the solution as follows:
 - Construct the truth table. [2 marks]
 - Find minimum SOP expression using Karnaugh map. [3 marks]
 - Realize the circuit for the Boolean expression obtained in part (ii). [2 marks]
- Realize the Boolean expression $f = \bar{A}B + A\bar{C}$ using NOR gates only. [4 marks]
- Show the output waveform for the three input circuit shown below with its proper time relationship to the inputs. [4 marks]



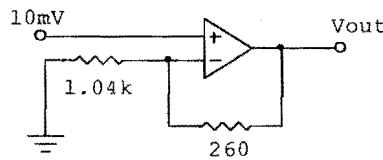
- Given the following components, design a synchronous counter that will count in the sequence 2, 1, 4, 7, 0 using JK flip-flops. The counter is to be self-starting and restart counting at 2 after 0. The final prototype must be a completely functional circuit which utilizes the 74LS47 BCD to 7 Segment Decoder/Driver. [20 marks]

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Question 3: Analog Electronics [6 marks]

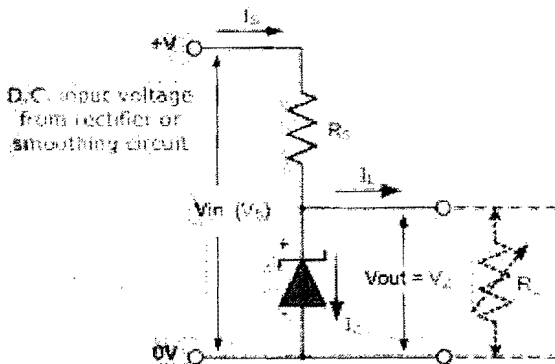
a) Given the inputs, calculate the output of the circuit given below. [2 marks]



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b) A 9.0 V stabilized power supply is required from a 12 V dc input source. The maximum power rating of the Zener diode is 3.47 W. Using the circuit given below, calculate:

- i) the maximum current flowing in the Zener diode [1 mark]
- ii) the value of the series resistor, R_s . [1 mark]
- iii) the total supply current, I_s when connected to a load of 1 k Ω . [2 marks]



THE END

ALL THE BEST FOR THE EXAMINATION