



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY  
SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING  
CERTIFICATE IV IN ELECTRONICS ENGINEERING

EEE418- ANALOG ELECTRONICS 1

FINAL EXAMINATION – PENSTER 2, 2016

DATE: TBA

TIME: TBA

NO. OF PAGES=9

**INSTRUCTIONS TO STUDENTS**

1. You are allowed 10 minutes Extra reading time during which you are NOT to write.
2. Begin each answer on a fresh page and use both sides of the sheet.
3. Write your candidate-number at the top of each attached sheet
4. Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string
5. For all sheets of paper on which rough/draft work has been done, cross it though and you MUST ATTACH to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. ANSWER ALL QUESTIONS.
8. Show all workings where necessary.
9. Do not use programmable calculators, especially the ones that does the conversions of number systems.
10. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE ROOM!**

**Section A**

**[20 marks]**

**Multiple Choice**

**(10 marks)**

**Part 1**

**Circle correct letter (A, B, C or D) against each of numbers 1 through 10.**

1. An Op-amp is
  - A) a power amplifier
  - B) basically a complete high-gain voltage amplifier in a small package
  - C) a video amplifier
  - D) a buffer amplifier
  
2. The common types of Op-amps are
  - A) Class A amplifiers
  - B) Class B amplifiers
  - C) Class AB amplifiers
  - D) Inverting, Non-inverting, Summing and Differentiator amplifiers
  
3. Oscillators are based on the principle of
  - A) positive feedback
  - B) negative feedback
  - C) amplifiers
  - D) AC input
  
4. The two classes of Oscillators based on their output shapes are
  - A) wave generators and sawtooth
  - B) rectangular and sinusoidal
  - C) sinusoidal and nonsinusoidal
  - D) sawtooth and trapezoidal
  
5. A tuned amplifier is
  
  
6. Tuned Op-amp circuits are generally classed as

- A) low-pass filters
- B) active filters
- C) high-pass filters
- D) band-pass filters

7. Three common types of active filters are the

- A) two-pole, one-pole and Butterworth filters
- B) one-pole, two-pole and three-pole filters
- C) high-pass, band-pass and notch filters
- D) Butterworth, Chebyshev and Bessel filters

8. A bidirectional thyristor is the

- A) 4-layer diode
- B) SCR
- C) Triac
- D) Silicon-controlled rectifier

9. A SCR turns off when the

- A) gate trigger current drops below a specified level
- B) anode current drops below the holding current
- C) gate current is more than the supply current
- D) none of the above

10. The common similarity between a Diac and Triac is that both devices

- A) are used in DC circuits
- B) are used in AC circuits
- C) are bidirectional
- D) are unidirectional

## **Part 2**

**(10 marks)**

### **Question 1**

**What the following acronyms mean and draw their respective symbols**

- a) SCR
- b) LED

- c) TRIAC
- d) DIAC
- e) Op-Amp

**SECTION B**

**[20 MARKS]**

**Question 1**

**TRUE OR FALSE (10 marks)**

**Write true or false for the following questions**

1. An op-amp contains a number of differential amplifier stages to achieve a very high voltage gain.
2. A noninverting amplifier has a virtual ground.
3. An oscillator can be regarded as an amplifier which provides its own input signal.
4. LEDs emit light when very current passes through them.
5. Thyristors are devices constructed of three transistors.

**Question 2**

**FILL IN THE BLANKS (10 marks)**

1. LEDs must have a resistor connected in \_\_\_\_\_ to limit the current value to prevent damage to it.
2. Thyristors are devices constructed of \_\_\_\_\_ semiconductor layers.
3. A SCR is a unidirectional device whereas a DIAC is \_\_\_\_\_
4. A DIAC has two terminals while the TRIAC has \_\_\_\_\_ terminal.
5. An amplifier that sums its input voltages is a \_\_\_\_\_ amplifier.

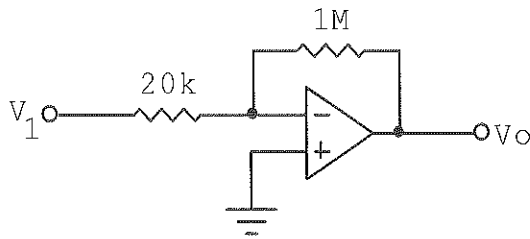
**Section C**

**[20 marks]**

**Question 1**

- a) Define a Thyristor (1 mark)
- b) The output of a particular op-amp increases 10V in 13 $\mu$ s. What is the slew rate in volts/ $\mu$ s? (2 marks)

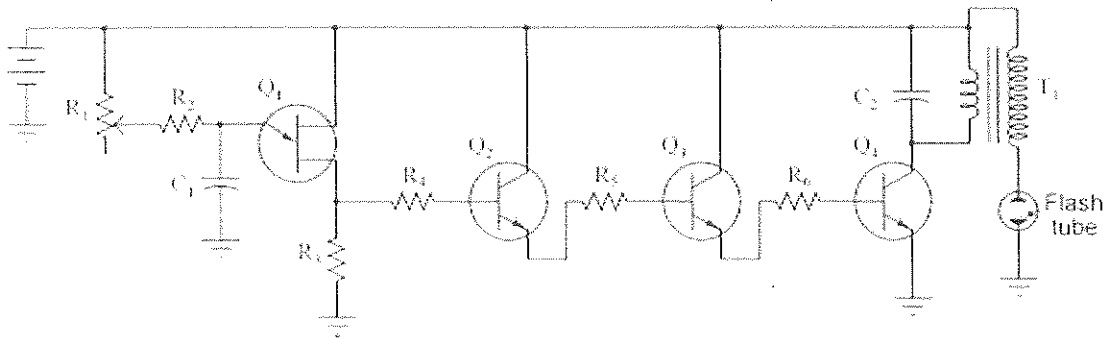
c) What input voltage results in an output of -3V in the circuit shown below?



(4 marks)

### Question 2

- Define an oscillator (1 mark)
- State the two necessary conditions for oscillations (2 marks)
- This circuit shown here is for a timing light: a device that uses a pulsed strobe lamp to "freeze" the motion of a rotating object.



Determine the following:

- Which component(s) forms the oscillator section (2 marks)
- what type of oscillator is used in this circuit (2 marks)
- which component values have a direct influence on the frequency of the flash tube output? (2 marks)

### Question 3

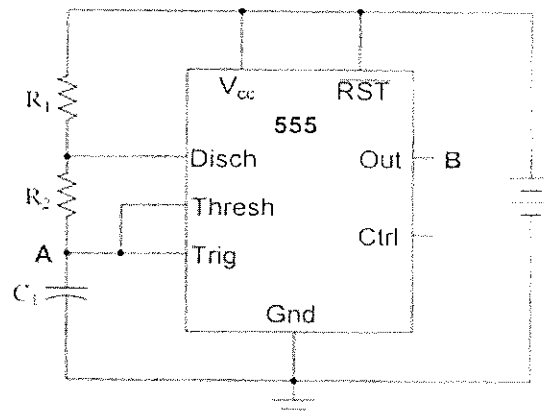
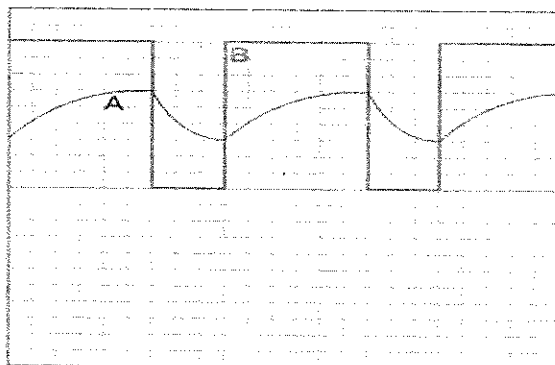
- a). Describe the purpose and operation of a crystal in an oscillator circuit. (2mark)
- b) What other components could be substituted in place of a crystal in an oscillator circuit (2 mark)

### Section D

[20 marks]

#### Question 1

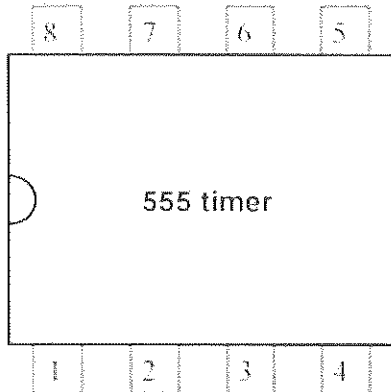
If were to measure the voltage waveforms at test points A and B with a dual-trace oscilloscope, we would see the following:



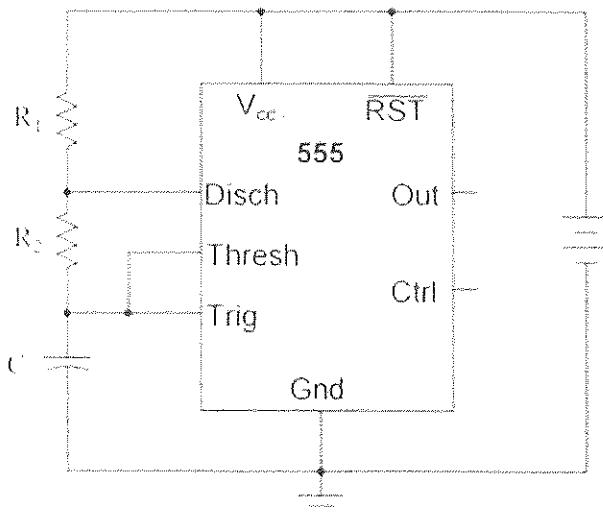
- a) Explain what is happening in this astable circuit when the output is "high". (3 marks)
- b) Explain what is happening in this astable circuit when the output is "low". (3 marks)

**Question 2**

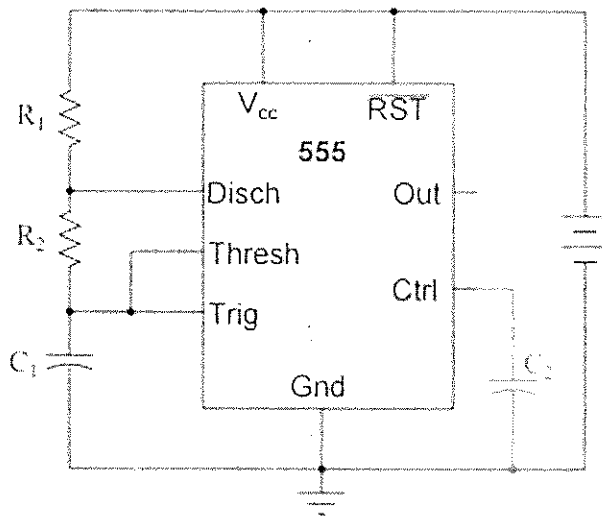
a) Label the pins for the 555 Timer below; (4 marks)



b) Write equations for the charging and discharging times of the capacitor, given the values of  $R_1$ ,  $R_2$ , and  $C$  in a circuit of this design: (6 marks)



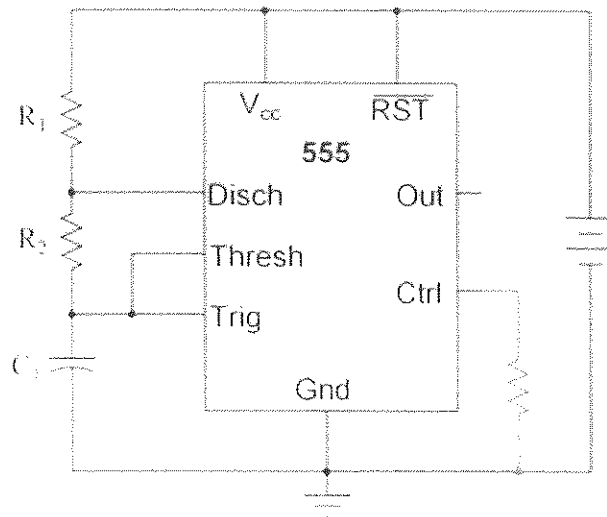
- c) It is common to see a capacitor connected between the "Control" terminal and ground in 555 timer circuits, especially when precise timing is important.



Explain what purpose the capacitor C2 serves in this circuit? **(2 marks)**

- d) What would happen to the operation of this astable 555 timer circuit if a resistor were accidentally connected between the "Control" terminal and ground? Explain the reason for your answer. **(2 marks)**





**Section E**

[20 marks]

**Question 1**

- a) Explain 2 methods of putting "off" a SCR. (6 marks)
- b) Give one similarity between the diac and triac (2 marks)
- c) Draw and label the characteristics curve of the diac (5 marks)

**Question 2**

- a) Name the three states of a Thyristor? (3 marks)
- b) Name one advantage of thyristors over transistors? (2 marks)
- c) Explain which device, thyristor or diac will function better in AC circuits. (2 marks)

=====THE END=====

