



**COLLEGE: COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)**

**SCHOOL: SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING**

**PROGRAMME: CERTIFICATE IV IN ELECTRONICS ENGINEERING-STAGE 4**

**UNIT CODE: EEE418**

**TITLE: ANALOG ELECTRONICS 2**

**FINAL EXAMINATION – PENSTER 4, 2017**

**ROOM: AS PER TIMETABLE**

**TIME: 2 HOURS 10 MINUTES**

**INSTRUCTIONS TO STUDENTS**

1. You are allowed 10 minutes extra reading time during which you are NOT to write.
2. Begin each SECTION 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 a string.
5. For all sheets of paper on which rough/draft work has been done, cross it through and ATTACH these to your answer scripts.
6. Write clearly the number(s) of the question(s) attempted on the top of each sheet.
7. Use of programmable calculator(s) is prohibited.
8. **ANSWER ALL QUESTIONS**
9. Show all working where necessary.
10. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE EXAM ROOM.**

**SECTION A**

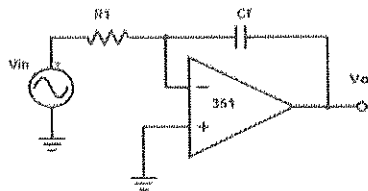
**MULTIPLE CHOICE**

**(10 MARKS)**

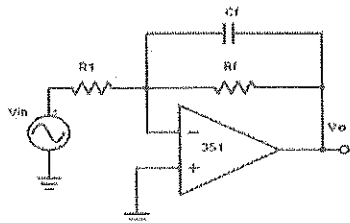
Circle the *letter* of the best *choice* in the **Answer Sheet** provided.

1. An oscillator differs from an amplifier because it \_\_\_\_\_.
  - a) Has more gain
  - b) Requires no input signal
  - c) Requires no d.c. supply
  - d) Always has the same input
2. For an oscillator to properly start, the gain around the feedback loop must initially be \_\_\_\_\_.
  - a) 1
  - b) Less than 1
  - c) Equal to attenuation of feedback circuit
  - d) Greater than 1
3. Find out the differentiator circuit from the given circuits?

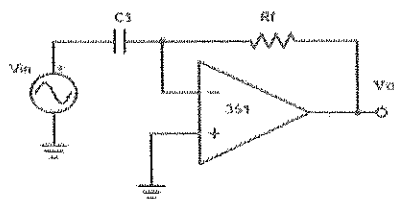
a)



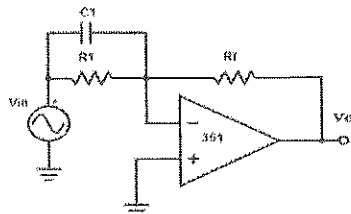
b)



c)



d)



4. The circuit in which the output voltage waveform is the integral of the input voltage waveform is called \_\_\_\_\_.
- a) Integrator
  - b) Differentiator
  - c) Phase shift oscillator
  - d) Square wave generator
5. A tuned amplifier is generally operated in ..... operation.
- a) Class A
  - b) Class C
  - c) Class B
  - d) All of the above
6. An SCR is sometimes called .....
- a) Triac
  - b) Diac
  - c) Unijunction transistor
  - d) Thyristor
7. A tuned amplifier is used in ..... applications.
- a) Radio frequency
  - b) Low frequency
  - c) Audio frequency
  - d) None of the above
8. An SCR is turned off by .....
- a) Reducing gate voltage to zero
  - b) Reverse biasing the gate
  - c) Reducing anode voltage to zero
  - d) None of the above
9. An LED is forward-biased. The diode should be on, but no light is showing. A possible trouble might be \_\_\_\_\_
- a) the diode is open.
  - b) the series resistor is too small.
  - c) none. The diode should be off if forward-biased.
  - d) the power supply voltage is too high.
10. Photo diode is used for detection of \_\_\_\_\_.
- a) visible light
  - b) invisible light
  - c) no light
  - d) both a and b

**SECTION B**

**(90 MARKS)**

**There are 5 parts to this question and all are compulsory.**

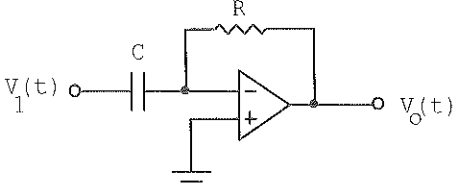
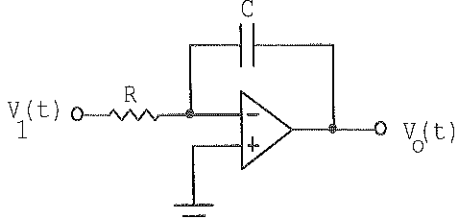
**PART 1:**

**OPERATIONAL AMPLIFIERS**

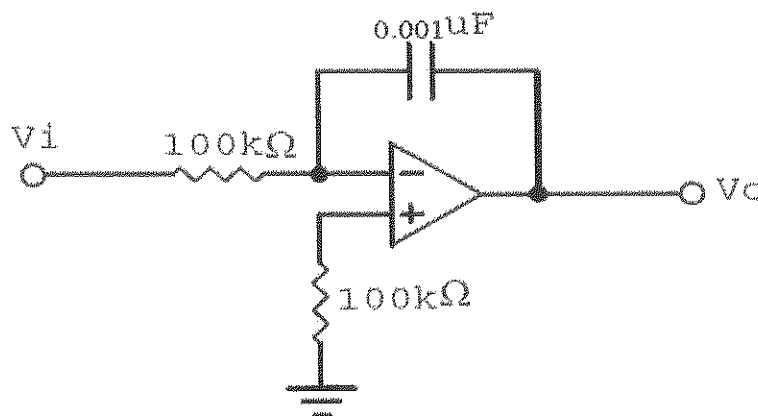
**(20 MARKS)**

1. Fill in the blank spaces.

(2 marks)

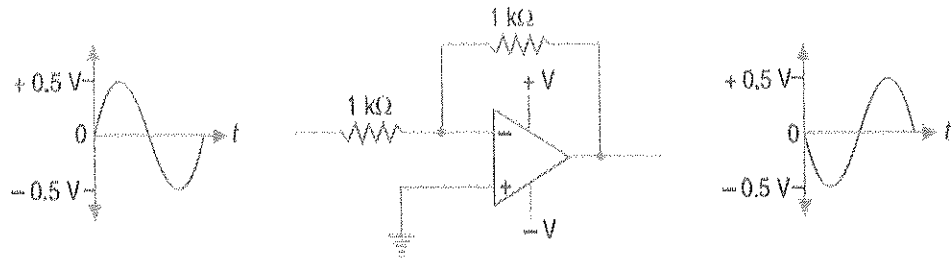
	Circuit	Name	Output Voltage, $V_o$
i.		Differentiator	
ii.		Integrator	

- When a pulse is applied to op-amp, the output goes from  $-6.9V$  to  $8.1V$  in  $0.1 \mu s$ . What is the slew rate in volts/ $\mu s$ ? (2 Marks)
- For the circuit shown below, find the peak value of the output of the ideal circuit if the output is  $V_i = 0.6 \sin(100t) V$ . (4 marks)



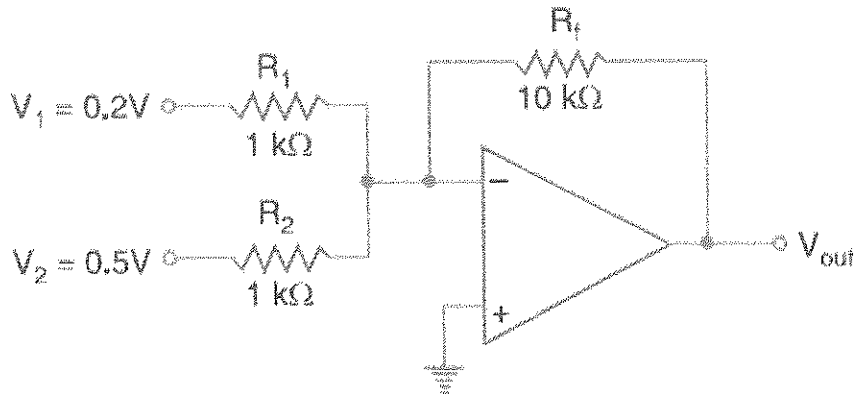
- A differential amplifier has an output of  $1V$  with a differential input of  $10 mV$  and an output of  $5 mV$  with a common-mode input of  $10 mV$ . Find the CMRR in dB. (3marks)

5. For the circuit shown below:

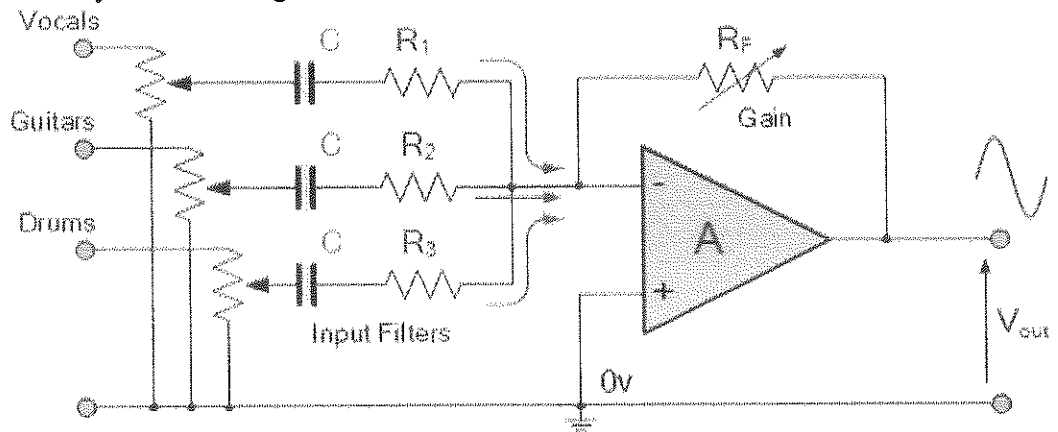


- identify the circuit (1 mark)
- Find the output voltage. (2 marks)

6. Determine the output voltage for the summing amplifier shown below: (3 marks)



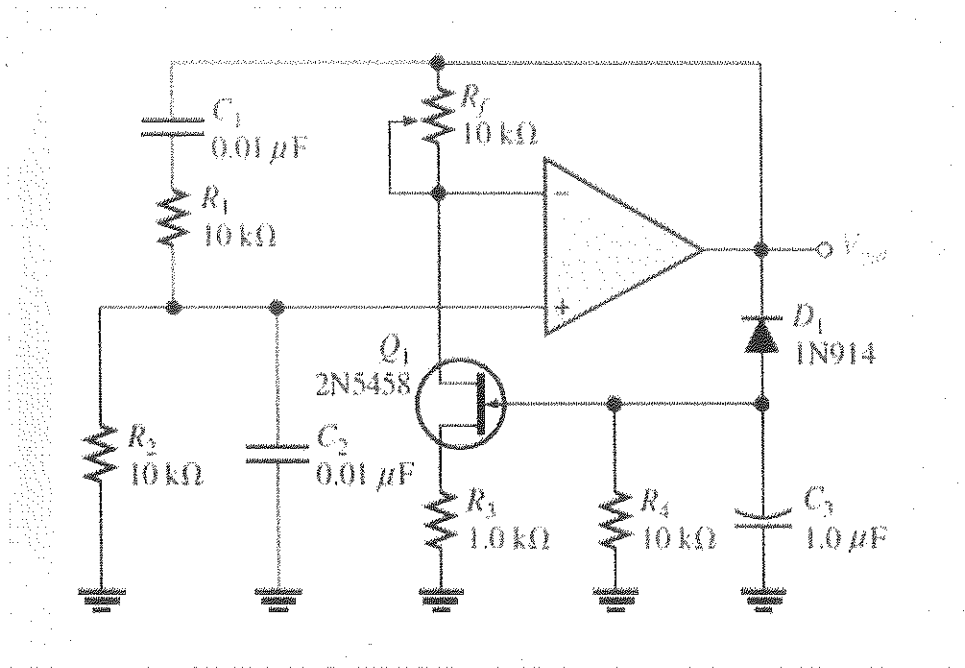
7. Identify the following circuit. (1 mark)



8. As a technician, you may encounter situations in which an op-amp or its associated circuitry has malfunctioned. The op-amp is a complex integrated circuit with many types of internal failures possible. Can you troubleshoot the opamp internally? What can be done to remedy this problem? (2 marks)

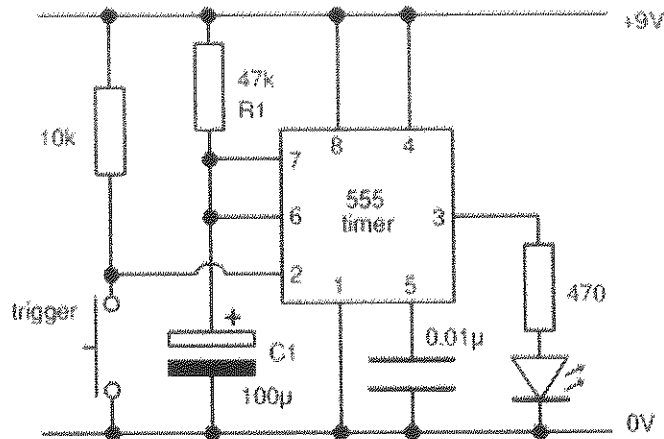
**PART II: OSCILLATORS & WAVEFORM GENERATORS (25 MARKS)**

1. Define an oscillator and draw the basic block diagram. (2 marks)
2. What are the 2 conditions for a sustained state of oscillation? (2 marks)
3. Define positive feedback? (2 marks)
4. Determine the resonant frequency for the Wien-bridge oscillator shown below: (2 marks)



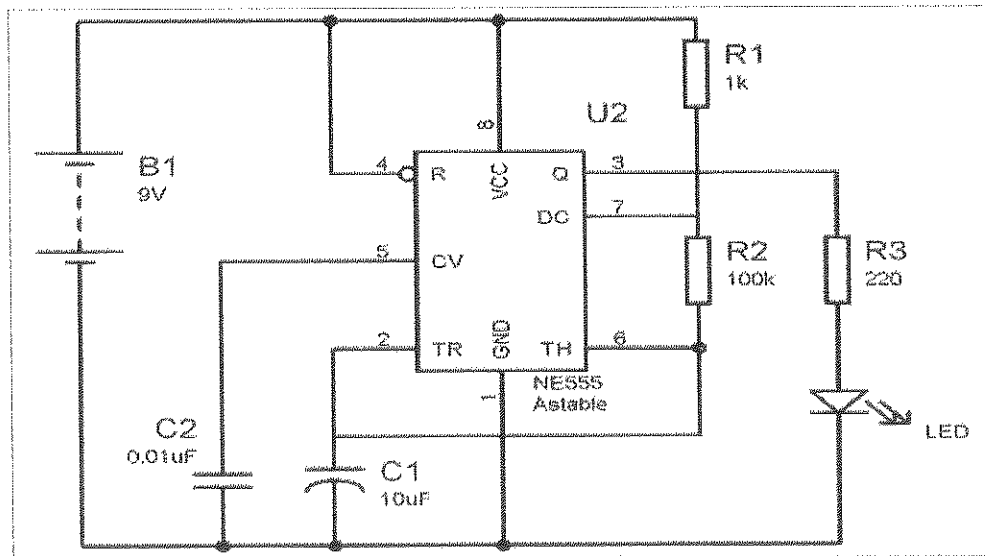
5. What is the difference between Colpitts and Hartley oscillator? (2 marks)
6. An inductance of 200mH and a capacitor of 10pF are connected together in parallel to create an LC oscillator tank circuit. Calculate the frequency of oscillation. (2 marks)
7. What is a crystal and state its advantage? (2 marks)

8. Refer to the diagram below and answer the questions that follow.



- a. Identify the circuit above. (1 mark)
- b. Calculate the time period of the LED. (2 marks)
- c. Identify the pins 1, 3, 5 and 8. (2 marks)

9. For the circuit shown below, calculate the:
- a. The output frequency from the 555 oscillator. (4 marks)
  - b. The duty cycle of the output waveform. (2 marks)



Hint:

$$f = \frac{1.44}{(R_1 + 2R_2)C_{ext}} \quad \text{555 astable frequency}$$

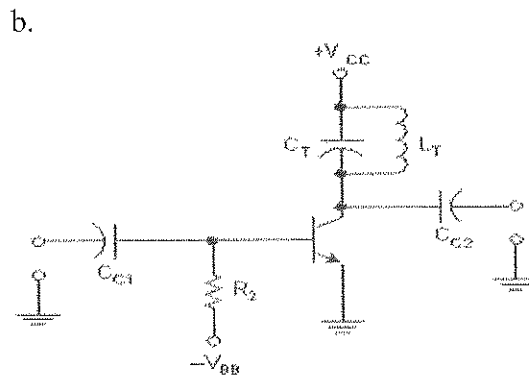
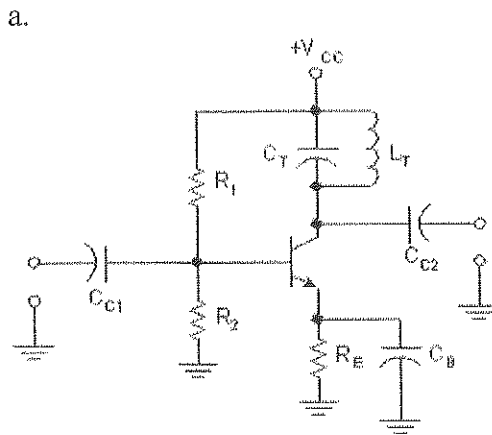
$$\text{Duty cycle} = \left( \frac{R_1 + R_2}{R_1 + 2R_2} \right) 100\% \quad \text{555 astable}$$

**PART III:**

**TUNED AMPLIFIERS**

**(15 MARKS)**

1. What is a tuned amplifier? (2 marks)
2. What are the applications of a tuned amplifier? (2 marks)
3. A tuned circuit has resonant frequency of 1600 kHz and bandwidth of 10kHz. What is the value of its Q-factor? (2 marks)
4. Tuned op-amp circuits are generally referred to as active filters. There are four basic types of active filters. Name the four types of active filters and sketch the frequency-response curves. (6 marks)
5. What is the function of a graphic equalizer? (1 mark)
6. Identify the diagrams below: (2 marks)



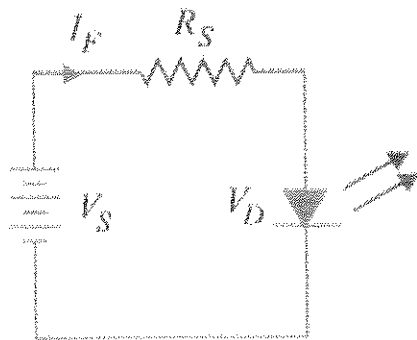


**PART IV:**

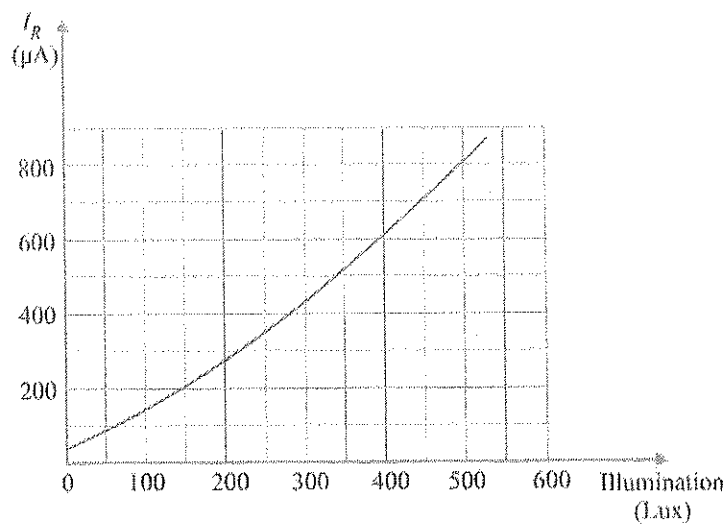
**OPTOELECTRONICS**

**(15 MARKS)**

1. Define the following terms:
  - a. Light Emitting (1 mark)
  - b. Light Activated (1 mark)
  - c. Optoelectronics (1 mark)
2. List three advantages of LED. (3 marks)
3. Draw the circuit symbols for the following: (4 marks)
  - a. phototransistor
  - b. photodiode
  - c. LED
  - d. photodarlington
4. What value of series resistor is required to limit the current through a LED to 20mA with a forward voltage drop of 1.6 V when connected to a 10V supply? (2 marks)



5. From the reverse current-Illumination curve for a photo-diode shown in Figure below, determine the dark resistance. Assume a reverse-biased voltage of 10 V. (3 marks)

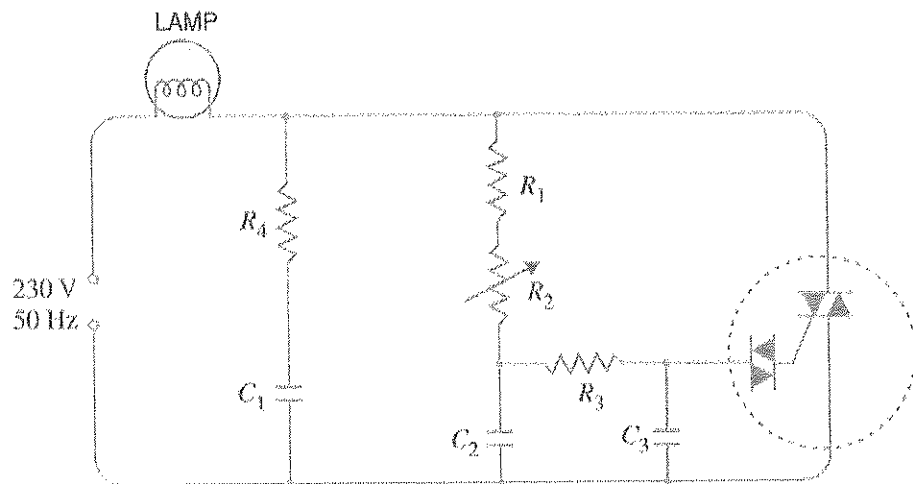


**PART V:**

**THYRISTORS**

**(15 MARKS)**

1. What are the two ways to drop the SCR out of conduction? (2 marks)
2. What is the purpose of a crowbar circuit? (1 mark)
3. Draw the circuit symbols of a Triac, SCR and Diac. (3 marks)
4. Give two application of SCR. (2 marks)
5. During the positive half-cycle of the ac, the triac is off for  $12^\circ$ . Calculate the following:
  - a) Delay angle (1 mark)
  - b) Conduction angle (1 mark)
6. For the circuit shown below:
  - a. identify the circuit. (1 mark)
  - b. Explain the circuit operation. (4 marks)



\*\*\*\*\***THE END**\*\*\*\*\*