

**FIJI NATIONAL UNIVERSITY****COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)****SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING****CERTIFICATE IV IN ELECTRONICS ENGINEERING-STAGE 4****EEE418- ANALOG ELECTRONICS 1B****FINAL EXAMINATION – PENSTER 4, 2013****DAY/DATE: TIME: ROOM: As per Timetable.****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

Multiple Choice

[20 Marks]

Choose the appropriate answer from each question and write it beside the number in your answer booklet.

1. The two input terminal of an op-amp are known as

- A. positive and negative
- B. differential and non-differential
- C. Inverting and non-inverting
- D. high and low

2. The output of a particular op-amp increases 4V in $6\mu\text{s}$. The slew rate is

- A. $96\text{V}/\mu\text{s}$
- B. $0.67\text{V}/\mu\text{s}$
- C. $1.5\text{V}/\mu\text{s}$
- D. none of the above.

3. An oscillator differs from an amplifier because

- A. it has more gain
- B. it requires no input signal
- C. it requires no dc supply
- d. it always has the same output

4. Majority of the oscillators are based on

- A. positive feedback
- B. negative feedback
- C. the piezoelectric effect
- D. high gain

5. One condition for oscillation is

- A. a phase shift around the feedback loop of 180°
- B. a gain around the feedback loop of one-third
- C. a phase shift around the feedback loop of 0°
- D. a gain around the feedback loop of less than one.

6. In a certain oscillator, $A_v = 50$. The attenuation of the feedback circuit must be

- A. 1
- B. 0.01
- C. 10
- D. 0.02

7. For an oscillator to properly start, the gain around the feedback circuit must be

- A. 1
- B. less than 1
- C. greater than 1
- D. equal to β

8. The wein-bridge oscillator has:

- A. Lead-lag network
- B. LC network
- C. Attenuation of $1/29$
- D. Negative feedback

9. A RC phase -shift oscillator has

- A. three RC circuits
- B. three LC circuit
- C. T-type circuit
- D. a π -type circuit

10. Colpiits and Hartley are names that refer to

- A. types of RC oscillators
- B. inventors of transistor
- C. types of LC oscillators
- D. types of oscillator

11. The main feature of crystal oscillator is

- A. economy
- B. reliability
- C. stability
- D. high frequency

12. Which of the following is not an input or output of the 555 timer?

- A. Threshold
- B. Control voltage
- C. Clock
- D. Trigger

13. LEDs are commonly fabricated from gallium compounds like gallium arsenide and gallium phosphide because they
- A. are cheap
 - B. are easily available
 - C. emit more heat
 - D. emit more light
14. A phototransistor excels a photodiode in the matter of
- A. faster switching
 - B. greater sensitivity
 - C. higher current capacity
 - D. both B and C
15. A photodarlington comprises of
- A. a phototransistor
 - B. a transistor
 - C. a photodiode
 - D. both A and B
16. Optical couplers are designed to one circuit from another
- A. control
 - B. none of the above
 - C. disconnect
 - D. protect
17. The specified value of holding current for an SCR means that
- A. the device will turn on and off when the anode current exceeds this value
 - B. the device will turn off when the anode current falls below this value
 - C. the device may be damage if the anode current exceeds this value
 - D. the gate current must be equal or exceed this value to turn the device on
18. In the forward-blocking region, the SCR is
- A. reverse-biased
 - B. in the off state
 - C. in the on state
 - D. at the point of breakdown

19. Choose the instrument that is **best** used to display waveforms.

- A. voltmeter
- B. multimeter
- C. ammeter
- D. Cathode Ray Oscilloscope

20. Which setting will you use to increase or decrease the amplitude on the cathode ray oscilloscope?

- A. Time/division setting
- B. Vertical positioning
- C. Voltage/division setting of the designed input
- D. Horizontal positioning

Section B

TRUE OR FALSE

[10 marks]

State true or false for the following questions in the answer booklet

1. An oscilloscope is used for tracing the signal and checking dc levels.
2. Signal tracing is important troubleshooting technique.
3. Resonant circuit is a tank circuit.
4. The Triac is like a bidirectional SCR.
5. Many power meters have scale calibrated in dBm.
6. Input bias current is the dc current required by the output of amplifier.
7. Negative feedback lowers the gain and increase the bandwidth.
8. Waveshaping is a process of altering the shape of a waveform to produce a new waveform with desired shapes.
9. Square wave generator is usually called a multivibrator.
10. An optocoupler combines light emitting device with the light sensitive devices in one package.

Section C

Theory Questions

[70 Marks]

Question 1

Operational Amplifiers

[15 Marks]

1. List four (4) characteristics of an ideal Op-amp. (4 marks)

2.

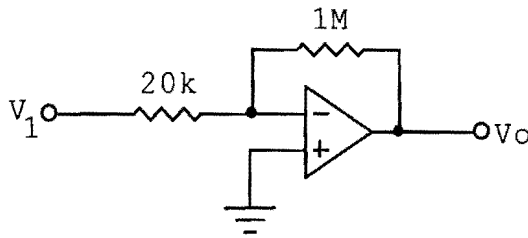
Match List A with List B.

LIST A		List B	
i.		A	Differentiator
ii.		B	Summing Amplifier
iii.		C	Integrator
iv.		D	Inverting Amplifier
v.		E	Non – inverting Amplifier
vi.		F	Unity follower

[6 marks]

3. What input voltage results in an output of -1V in the circuit shown below?

(2marks)



4. a). Define slew rate?

(1 mark)

b). The output of a particular op-amp increases 8V in 12 μ s. What is the slew rate in volts/ μ s?

(2 marks)

Question 2

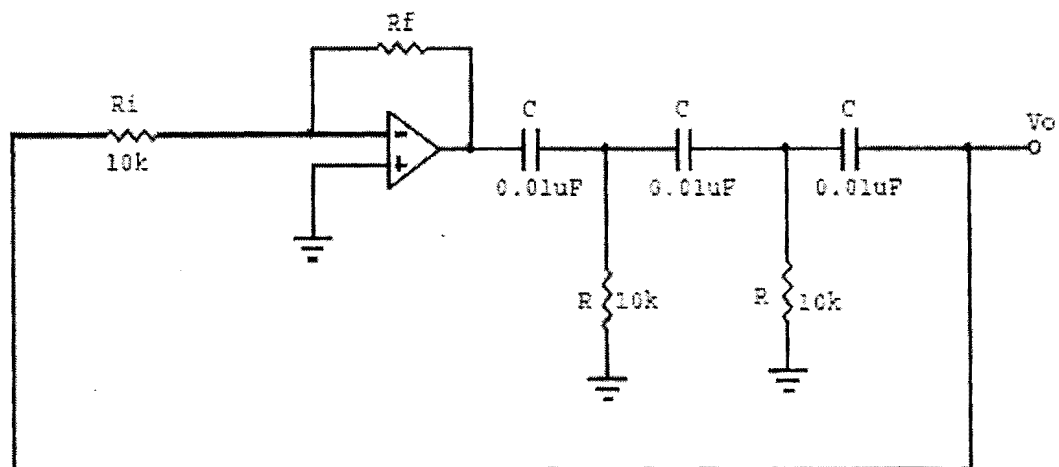
Oscillators & Waveform Generators

[20Marks]

1. List Two (2) necessary conditions required for a circuit to oscillate.

(2 marks)

2. An oscillator is shown below:



Determine the following quantities:

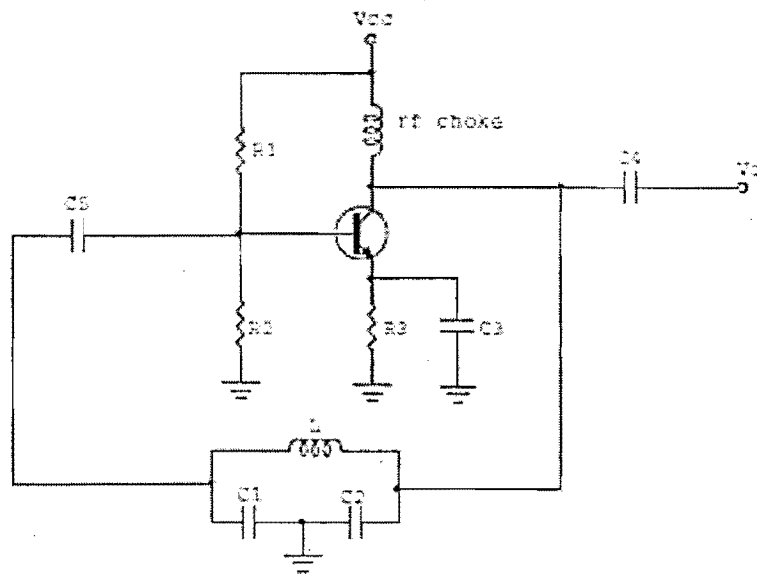
i). the value of R_f necessary for the circuit to operate as an oscillator

(2 marks)

ii). The frequency of oscillation

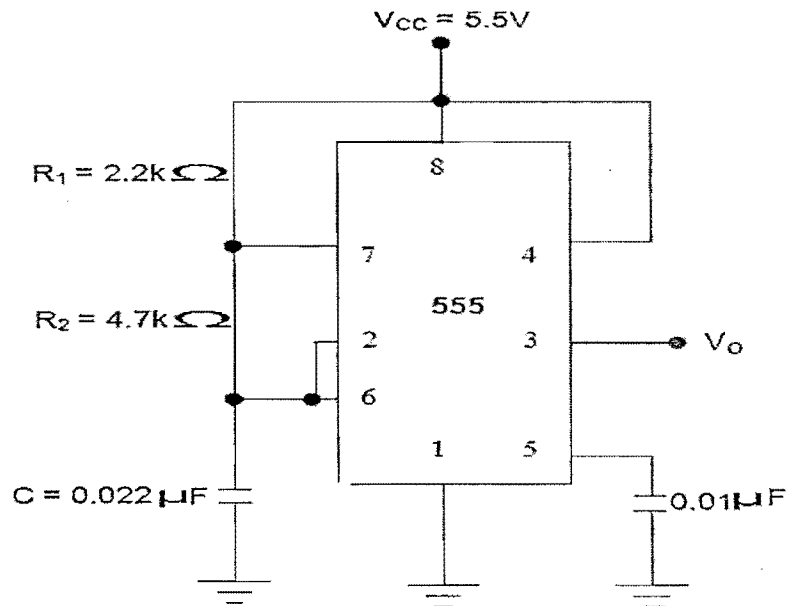
(1 marks)

3. For the below circuit $L=50\text{mH}$, $C_1 = 0.1\mu\text{C}$ and $C_2 = 0.01\mu\text{C}$.



- i). Identify the oscillator type. (1 mark)
- ii). Determine the frequency of oscillation. Assume there is negligible loading on the feedback circuit and its Q is greater than 10. (2 marks)
- iii). Find f_r if the oscillator is loaded to a point where the Q drops to 8. (2 mark)

4. A 555 timer configured to run in *Astable* mode is shown below:



Determine the following:

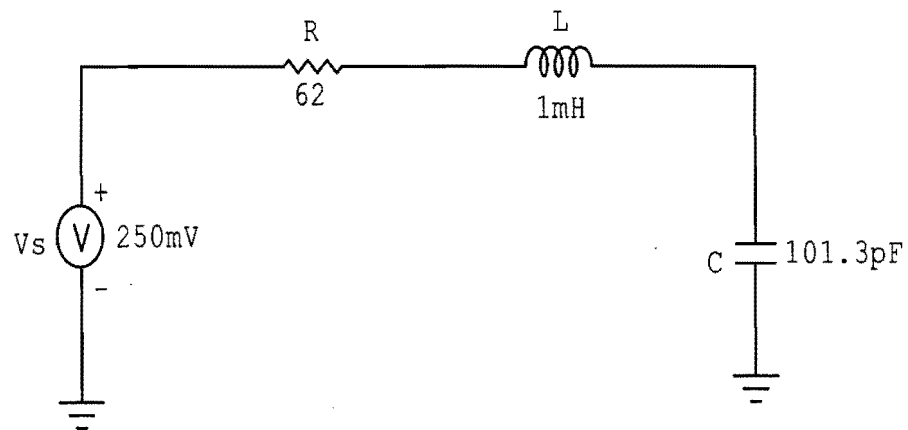
- i). T_{Low} (2 marks)
- ii). T_{HIGH} (2 marks)
- iii). T (2 marks)
- iv). $f_{osc.}$ (2 marks)
- v). Duty cycle (2 marks)

Question 3

Thyristors / Tuned amplifiers

[15 Marks]

1. a). Give **two** application of SCR (2 mark)
- b). State the **two** methods of switching off an SCR. (2 marks)
2. Sketch the Current, I versus Voltage, V characteristic curve for the SCR at $I_G=0$, clearly indicate a relevant parameters and regions. (3 marks)
3. a). Sketch the typical Gain Vs Frequency characteristic for a tuned amplifier and clearly label all relevant parameters. (3 mark)
- b). Give an application of tuned amplifier. (1 mark)
4. A tuned amplifier circuit is shown below:



Determine the frequency of resonance, f_o . (2 marks)

5. Tuned op-amp circuits are generally referred to as **active filters**. What are the Four (4) basic types of active filters:

(2 mark)