



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

**SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING**

**CERTIFICATE IV IN ELECTRONICS ENGINEERING**

**EEE413- ANALOG ELECTRONICS**

**FINAL EXAMINATION – TRIMESTER 2, 2015**

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

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

2. 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

3. What is the function of the Rectifier?

- A. converts analog signal to digital
- B. amplifying the output signal
- C. converts digital signal to analog
- D. increases the power level at the output

4. 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

5. 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.

6. BJT is a \_\_\_\_\_ controlled device. The JFET is a \_\_\_\_\_ controlled device

- A. Voltage, voltage
- B. Voltage, Current
- C. Current, Voltage
- D. Current, Current

7. The  $\beta_{DC}$  of a transistor is its

- A. Current gain
- B. Voltage gain
- C. Power gain
- D. Internal resistance

8. A FETs have similar properties to

- A. PNP transistor
- B. NPN transistor
- C. Thermionic valves
- D. Unijunction transistor

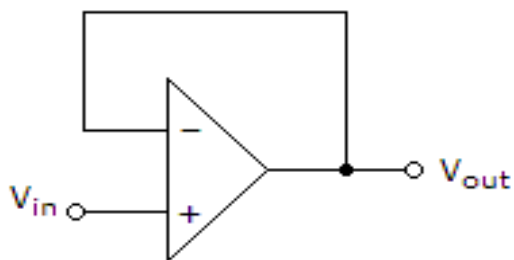
9. A transistor has a  $\beta_{DC}$  of 250 and a base current,  $I_B$ , of  $20 \mu\text{A}$ . The collector current,  $I_C$ , equals:

- A.  $500 \mu\text{A}$
- B.  $5 \text{ mA}$
- C.  $50 \text{ mA}$
- D.  $5 \text{ A}$

10. To operate properly, a transistor's base-emitter junction must be forward biased with reverse bias applied to which junction?

- A. Collector-Emitter
- B. Base- Collector
- C. Base-Emitter
- D. Collector-Base

11. Refer to the given figure. This amplifier is known as

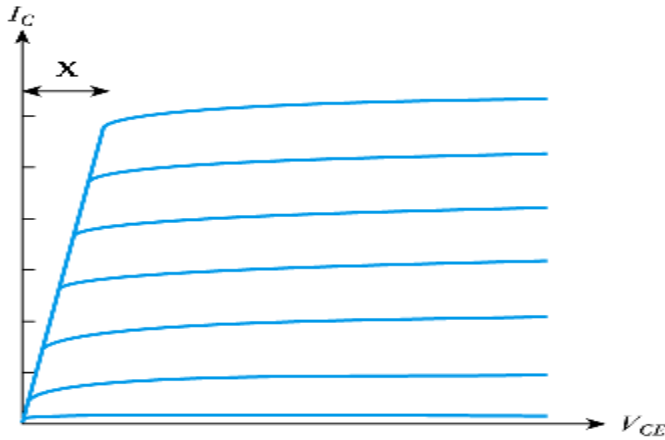


- A. Inverting Amplifier
- B. Non-inverting amplifier
- C. voltage follower
- D. common source amplifier

12. Voltage gain of an ideal op-amp is:

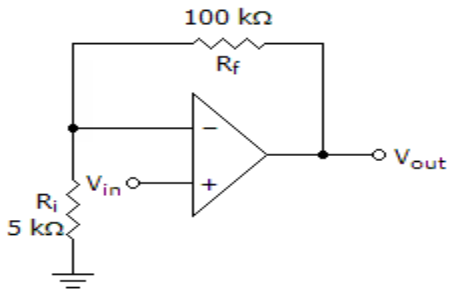
- A. very low
- B. low
- C. infinite
- D. very high

13. In the bipolar transistor output characteristics shown below, what region is represented by the symbol 'X'?



- A. Breakdown region
- B. Saturation region
- C. Ohmic region
- D. Active region

14. Refer to the given figure. The voltage gain of this amplifier is



- A. 5
- B. 20
- C. 21
- D. 100

15. The voltage gain of a given common-source JFET amplifier depends on its

- A. input impedance
- B. amplification factor
- C. dynamic drain resistance
- D. drain load resistance

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

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

17. Which of the following describes power amplifiers?

- A. It can handle large power
- B. It can handle large current
- C. It does not provide much voltage gain
- D. All of the above

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. 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

20. Majority of the oscillators are based on

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

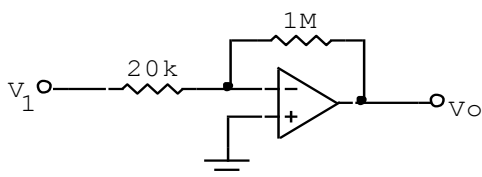
**Section B****Matching****[10 Marks]**

Match Column A with Column B.

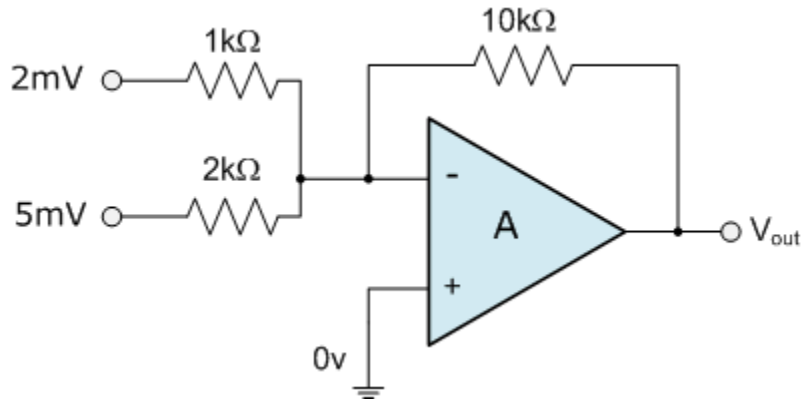
COLUMN A		COLUMN B	
1	NPN Bipolar Transistor	A	
2	PNP Bipolar Transistor	B	
3	Darlington Transistor	C	
4	JFET-N Transistor	D	
5	JFET-P Transistor	E	
6	NMOS Transistor	F	
7	PMOS Transistor	G	
8	Ground	H	
9	Speaker	I	
10	OP -Amp	J	

**Section C****Theory Questions****(40 MARKS)**

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

**(2marks)**

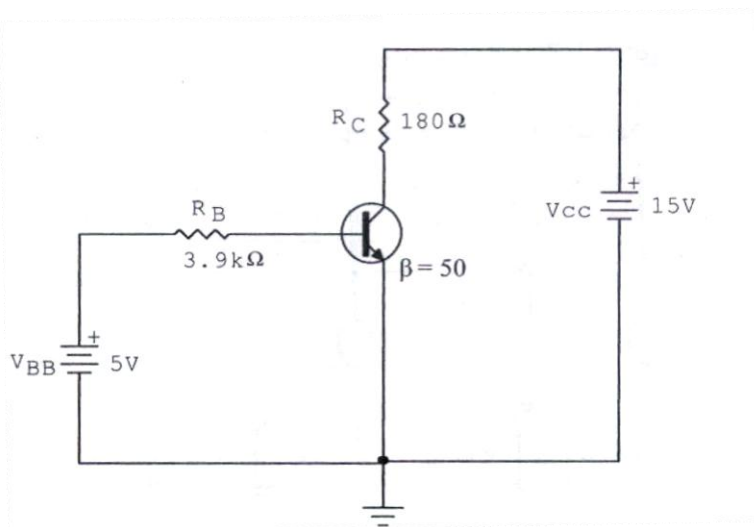
2. Find the output voltage of the following **Summing Amplifier** circuit.



(2 marks)

3. Determine  $\beta_{DC}$ ,  $I_E$  and  $\alpha_{DC}$  for a transistor where  $I_B = 50\mu A$  and  $I_C = 3.65mA$ . (3 marks)

4. A silicon transistor having  $\beta = 50$  is shown below.



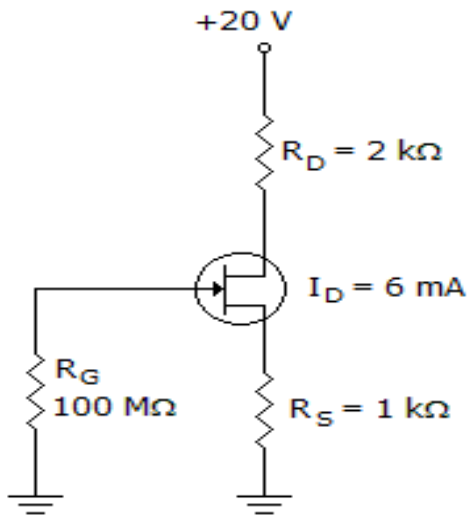
Determine the following:

- |       |          |          |
|-------|----------|----------|
| (i)   | $V_{BE}$ | (1 mark) |
| (ii)  | $I_B$    | (1 mark) |
| (iii) | $I_C$    | (1 mark) |
| (iv)  | $I_E$    | (1 mark) |
| (v)   | $V_{CE}$ | (1 mark) |
| (vi)  | $V_{CB}$ | (1 mark) |

5. List down the 4 types of transistor biasing methods. (2 marks)

6. Find  $V_{DS}$  and  $V_{GS}$  in the figure below, given that  $I_D = 6\text{mA}$

**(3 Marks)**



7. List two types of Sinusoidal Oscillation.

**(2 marks)**

8. A class C amplifier is driven by a 200 kHz signal. The transistor is on for  $1\mu\text{s}$ , and the amplifier is operating over 100 percent of its load line. If  $I_{C(sat)} = 100\text{mA}$  and  $V_{CE(sat)} = 0.2\text{V}$ , what is the average power dissipation?

**(3marks)**

9. Define power amplifiers and state its application.

**(2 marks)**

10. What are the highest possible efficiency for Class A, Class B, Class AB and Class C power amplifiers?

**(2 marks)**

11. i) A class A amplifier has a current gain of 75 and voltage gain of 50. Calculate the power gain.

**(2 marks)**

ii) A class A amplifier is biased with a centred Q-point at  $V_{CEQ} = 5\text{V}$  and  $I_{CEQ} = 10\text{mA}$ . Calculate maximum output power?

**(2 marks)**

12. Name at least four types of Transistor Oscillators you know

**(4 marks)**

13. i) What is heat sink made of?

**(1 mark)**



ii) What is the function of heat sink?

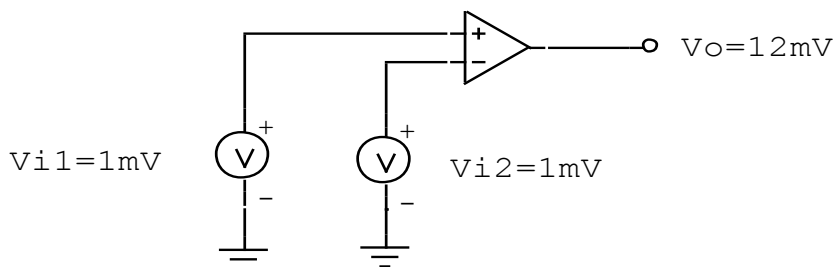
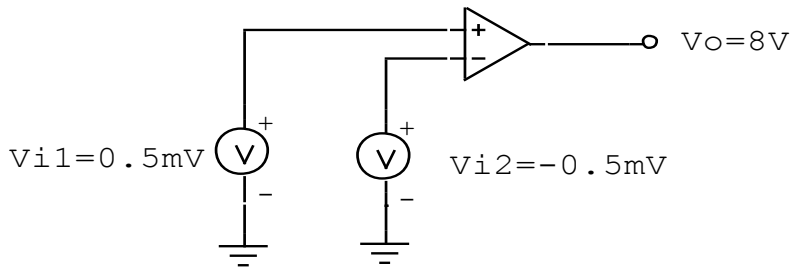
(1 mark)

iii) Why are the heat sinks mostly fin shaped?

(1 mark)

14. Calculate the CMRR (in dB) using the circuit measurements shown in figure 1 & 2 below.

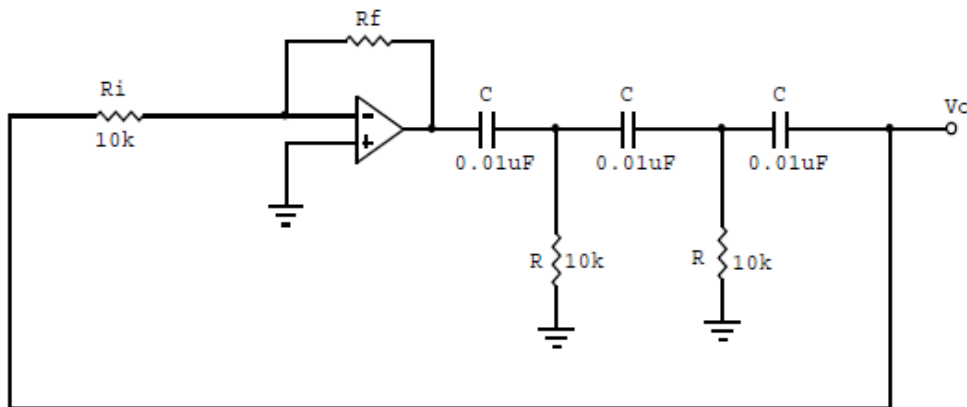
(4 marks)



**SECTION D**

**[30MARKS]**

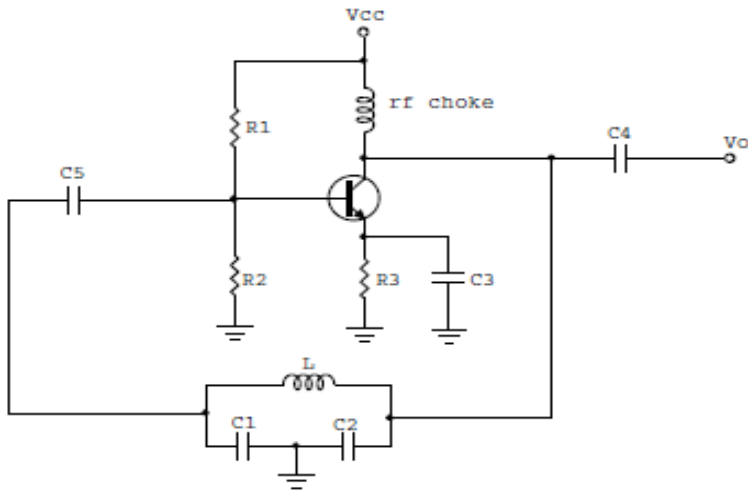
1. An oscillator is shown below:



i). the value of  $R_f$  necessary for the circuit to operate as an oscillator (2 marks)

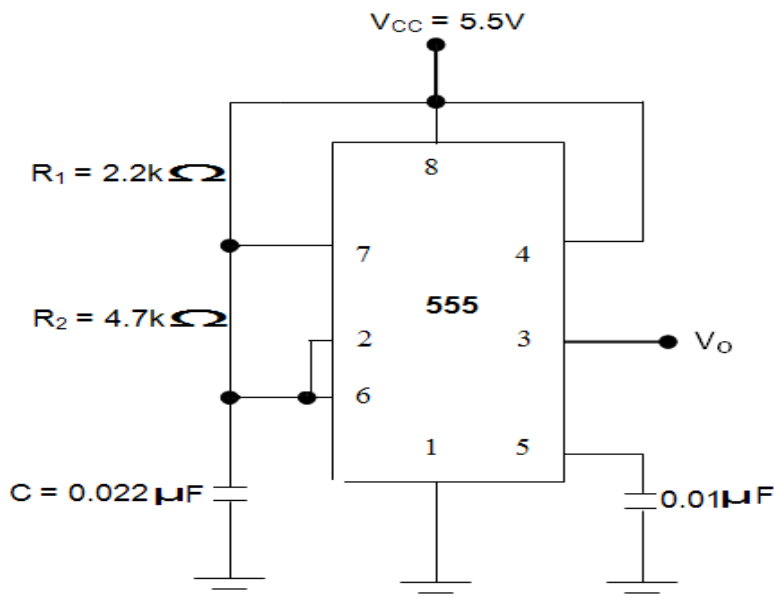
ii). The frequency of oscillation (1 marks)

2. 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 marks)**

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



Determine the

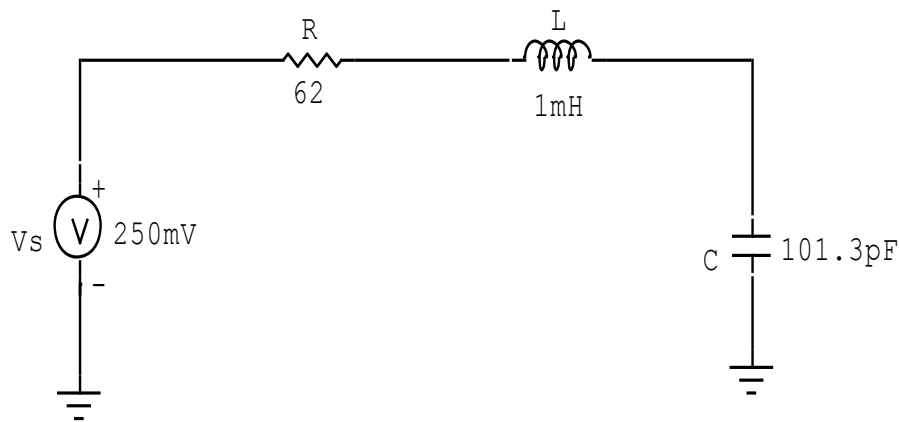
following:

- i).  $T_{Low}$  (1 mark)
- ii).  $T_{HIGH}$  (1mark)
- iii).  $T$  (1 mark)
- iv).  $f_{osc.}$  (1 mark)
- v). Duty cycle (1 mark)

4. Give **two** application of SCR (2 marks)

5. Sketch the Current,  $I$  versus Voltage,  $V$  characteristic curve for the SCR at  $I_G=0$ , clearly indicate all relevant parameters and regions. (3 marks)

6. A tuned amplifier circuit is shown below:



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

7. Design an LED voltage indicator of  $9V_{dc}$  supply. Assume current through series resistor is  $10\text{mA}$  and the voltage across LED is  $1.7$  volts. Find the value of series resistor? (3 marks)

8. Draw and briefly explain the circuit diagram of a Full – wave bridge rectifier connected from a step down transformer. Also sketch the input and output waveforms of it. (6 marks)

**THE END**