FNU FIJI NATIONAL UNIVERSITY

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

SCHOOL: SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

PROGRAMME: CERTIFICATE IV IN ELECTRONICS ENGINEERING-STAGE 2

UNIT CODE: EEE413

TITLE: ANALOG ELECTRONICS 1A

FINAL EXAMINATION – TRIMESTER 2, 2016

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. A PN junction allows current flow when _____.
   a) both the n-type and p-type materials have the same potential
   b) there is no potential on the n-type or p-type materials
   c) the p-type material is more positive than the n-type material
   d) the n-type material is more positive than the p-type material

2. Which type of transformer is required to create a 180 degree input to a rectifier?
   a) Split winding primary
   b) Center-tapped secondary
   c) Stepped-up secondary
   d) Step-down secondary

3. Testing a good diode with an ohmmeter should indicate _____.
   a) low resistance when forward or reverse biased
   b) high resistance when forward or reverse biased
   c) high resistance when reverse biased and low resistance when forward biased
   d) high resistance when forward biased and low resistance when reverse biased

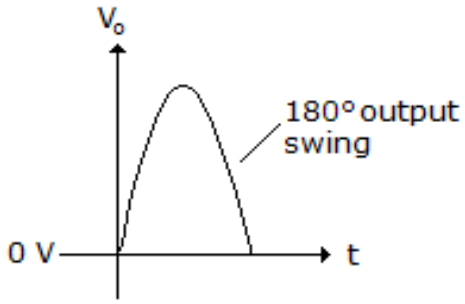
4. What is the dc current gain β_{DC} for a transistor where $I_E = 3.7$ mA and $I_C = 3.65$ mA?
   a) 16.80
   b) 200
   c) 100
   d) 73

5. It takes an op-amp 22µs to change its output from –15 V to +15 V. Determine the slew rate.
   a) 1.36 V/µs
   b) -0.68 V/µs
   c) 0.68 V/µs
   d) Cannot determine

6. If the gain of a closed-loop inverting amplifier is 3.9, with an input resistor value of 1.6 KΩ, what value of feedback resistor is necessary?
   a) 2.4 KΩ
   b) 6240 Ω
   c) 410 Ω
   d) 0.62 KΩ

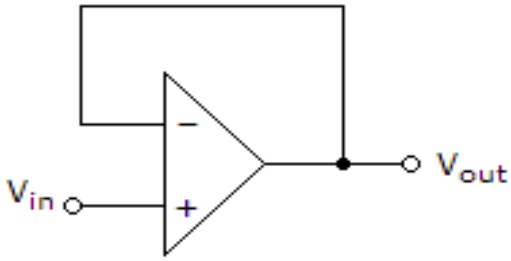
7. When V_{GS} = 0V, a JFET is _____.
    a) an analog device
    b) an open switch
    c) cut off
    d) saturated

8. This is an example of the output swing for a class _____ amplifier.



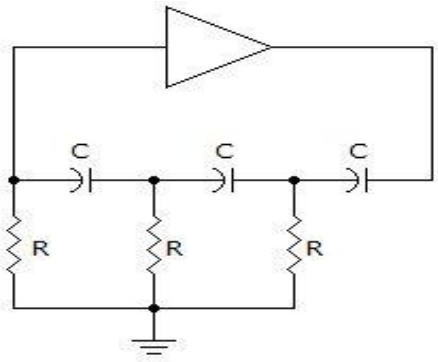
    a) AB
    b) A
    c) B
    d) C

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



    a) an inverting-amplifier
    b) a non-inverting amplifier
    c) voltage-follower
    d) a common-source amplifier

10. This circuit is a _____ oscillator.



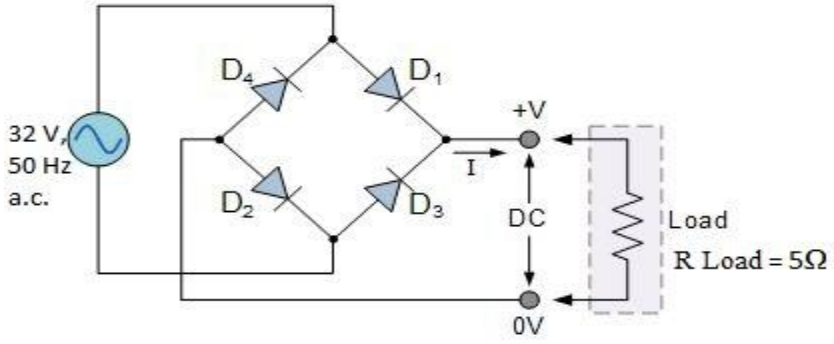
a) Phase-shift
b) Wien bridge
c) Hartley
d) Colpitts

SECTION B (90 MARKS)

There are 6 parts to this question and all are compulsory.

PART 1: Rectifiers & Simple Power Supplies (15 MARKS)

1. For the circuit shown below, determine the following:



a. Identify the circuit. (1 mark)
b. the load voltage. (1 mark)
c. the load current. (1 mark)
d. the ripple voltage. (1 mark)
e. the ripple frequency. (1 mark)
f. the PRV. (1 mark)

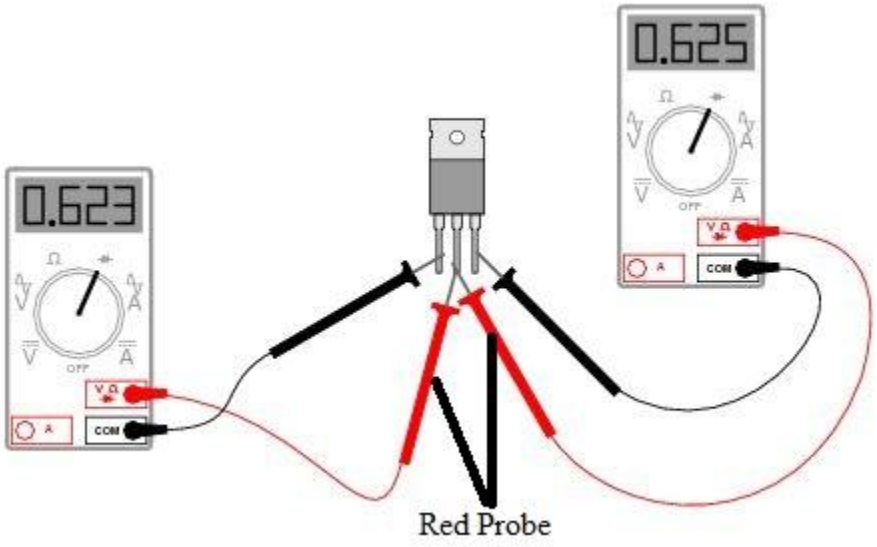
2. Draw the flow diagram of a basic power supply and briefly explain the main processes that take place before a good clean DC voltage is produced.
(6 marks)

3. List down 3 uses of a Zener diode. (3 marks)

PART II: **Discrete Amplifying Devices** **(20 MARKS)**

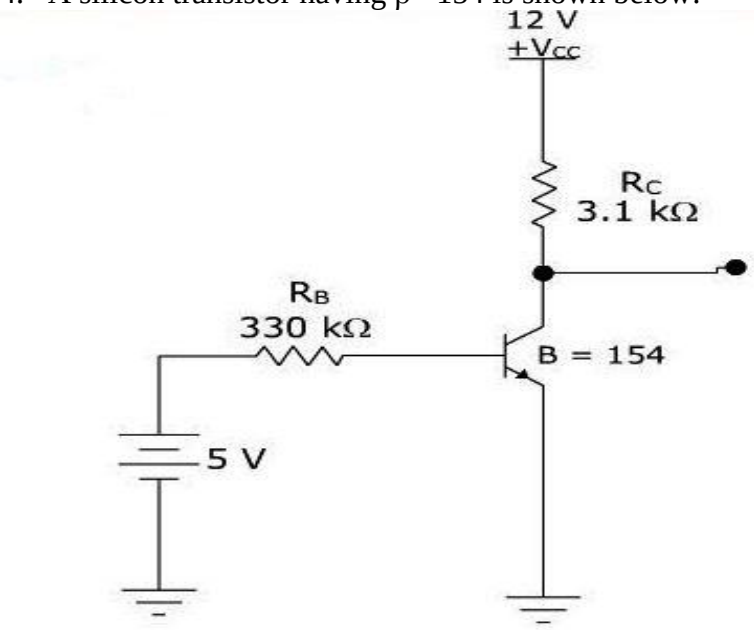
1. Determine β_{DC}, I_E and α_{DC} for a transistor where I_B= 50µA and I_C = 3.65mA.
(3 marks)

2. Identify the terminals on this BJT, and also the type of BJT it is (NPN or PNP):
(2 marks)



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

4. A silicon transistor having β= 154 is shown below:



For the circuit show above, determine the following:

a) V_{CE} (2 marks)
b) V_{CB} (2 marks)

5. Given $V_{GS\ (Off)} =$ -5V, determine the Pinch-off voltage? (1 mark)

6. What three areas are the drain characteristics of a JFET ($V_{GS} = 0$) divided into? (3 marks)

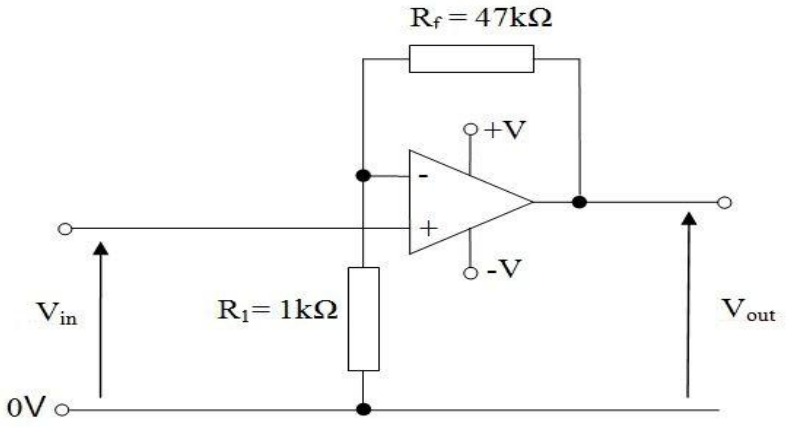
7. Compare FETs with BJT. (3 marks)

8. A certain JFET has an I_{GSS} of 2nA for V_{GS} = -15V. Determine the input resistance. (2 marks)

PART III: **Op-amps & Power Amplifiers** **(20 MARKS)**

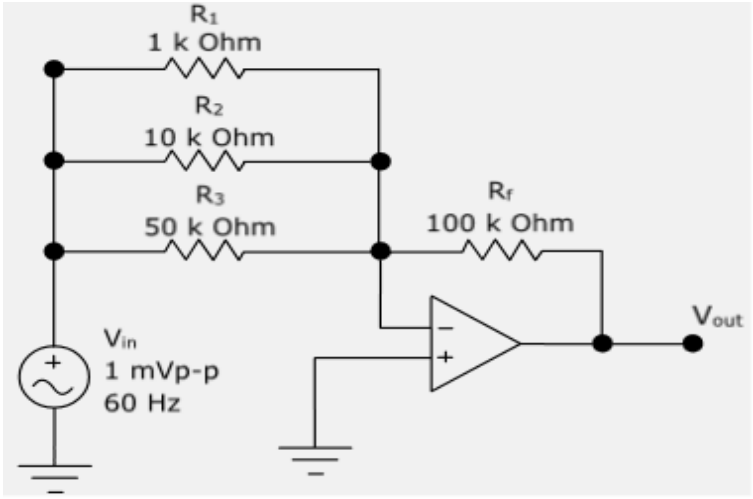
1. List down four main properties of real and ideal op-amp. Identify in terms of A_d , CMRR,R_{in} , and R_{out} . (4 marks)

2. For the circuit shown below, determine the following:



   a) Identify the circuit. (1 mark)
   b) What is the voltage gain of this amplifier? (2 marks)
   c) If V_{in} = 50mV, determine the value of V_{out}? (3 marks)

3. Given the circuit below, calculate the V_{out}. (4 marks)



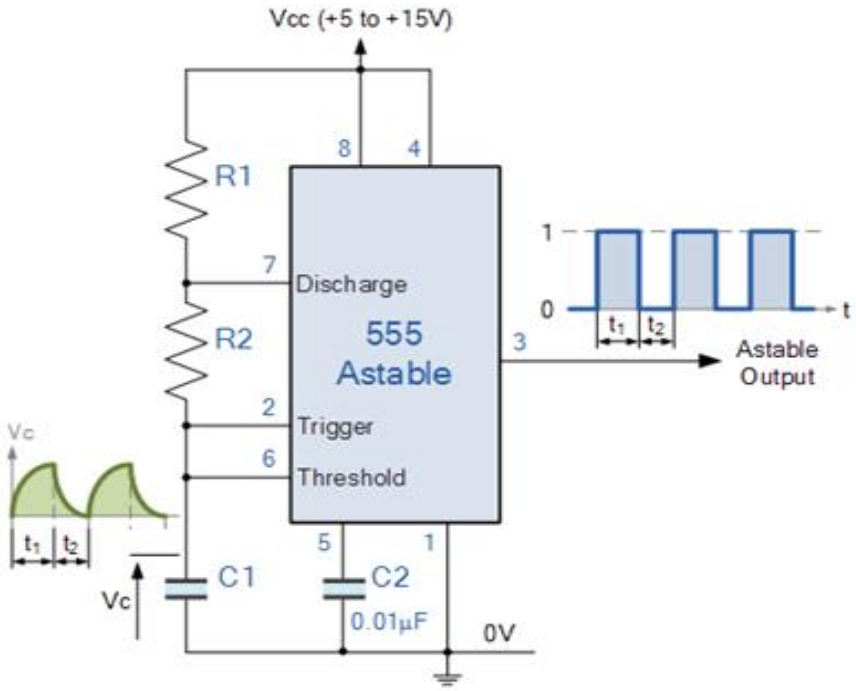
4. Define power ampliers and state it's application. (2 marks)
5. A class C amplifier is driven by a 250 kHz signal. The transistor is on for 0.5µs, and the amplifier is operating over 100 percent of its load line.If $I_{C\,(sat)}$ = 110mA and $V_{CE\,(sat)}$ =0.25V, what is the average power dissipation? (4 marks)

PART IV: **Oscillators & Waveform Generators** **(15 MARKS)**

1. Define an oscillator. (1 mark)

2. State the two necessary conditions for oscillation. (2 marks)

3. 555 Oscillator is constructed using the following components, R1 = 1kΩ, R2=2kΩ and capacitor C1 =C_{ext} = 10uF as shown below.



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

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

Calculate:

a) The output frequency from the 555 oscillator. (4 marks)
b) The duty cycle of the output waveform. (2 marks)

4. Determine the maximum and minimum frequency of oscillations of a Wien bridge Oscillator circuit having a resistor of 10KΩ and a variable capacitor of 1nF to 1000nF. (f_r = 1/ 2πRC) (3 marks)

5. What is the voltage gain condition for oscillator start up.

(3 marks)

PART V: **Tuned Amplifiers & Optoelectronics** **(10 MARKS)**

1. Tuned op-amp circuits are generally referred to as **active filters**. List down ***four*** basic types of active filters. (2 marks)

2. Give an application of Tuned Amplifier. (1 mark)

3. A tuned amplifier is designed to have a resonant frequency of 1000 kHz and a bandwidth of 40 kHz. What is the *Q* of this amplifier? (2 marks)

4. Define the following terms:
   a. Light Emitting (1 mark)
   b. Light Activated (1 mark)
   c. Optoelectronics (1 mark)

5. List three LED performance measures (2 marks)

PART VI: **Thyristors** **(10 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^{o}. Calculate the following:
   a) Delay angle (1 mark)
   b) Conduction angle (1 mark)

**********THE END **********