



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY SCHOOL
OF BIOLOGICAL AND PHYSICAL SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION
SCIENCE WITH IT
3RD YEAR 1ST SEMESTER 2016/2017 ACADEMIC YEAR
MAIN CAMPUS**

COURSE CODE: SPH 307

COURSE TITLE: INTRODUCTION TO ELECTRONICS

EXAM VENUE: LR 1

STREAM: (BED Sc.)

DATE: 22/04/16

EXAM SESSION: 11.30 – 1.30 PM

TIME: 2 HOURS

Instructions:

- 1. Answer question 1 (compulsory) and ANY other 2 questions.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

SPH 307INTRODUCTION TO ELECTRONICS 2016.17 SEM I MS

INSTRUCTIONS TO CANDIDATES

Answer all questions in **SECTION A** and any **TWO** questions from **SECTION B**.

Question **ONE** carries **30** marks while all the other questions carry **20** marks each.

QUESTION 1 (30 MARKS)

- a) State Barkhausen criterion **1mk**
- b) Define the term ‘phase reversal’ as used in common emitter amplifiers **1mk**
- c) Semiconductors have negative temperature coefficient of resistance. Explain **2mks**
- d) Sketch current – voltage (IV) characteristics of a PN junction **2mks**
- e) Give any two differences between an alternator and an oscillator **2mks**
- f) A differential amplifier has an open-circuit voltage gain of 200. The input signals are 3.35 V and 3.15V. Determine the output voltage. **2mks**
- g) Determine the current I in the circuit shown in Figure 1. Assume the diodes to be of silicon and forward resistance of diodes to be zero. **3mks**

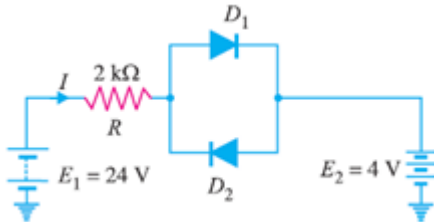


Figure 1

- h) What happens when a p-type semiconductor is joined to an n-type semiconductor material? **3mks**
- i) For a transistor, $\beta = 45$ and voltage drop across $1k\Omega$ which is connected in the collector circuit is 1 volt. Find the base current for common emitter connection. **3mks**
- j) In a transistor circuit, collector load is $4k\Omega$ whereas quiescent current (zero signal collector current) is 1mA.
 - (i) What is the operating point if $V_{CC} = 10V$? **2mks**
 - (ii) What will be the operating point if $R_C = 5k\Omega$? **2mks**
- k) With an aid of a diagram identify the three transistor configurations **3mks**
- l) The circuit of Figure 2 uses two Zener diodes, each rated at 15 V, 200 mA. If the circuit is connected to a 45-volt unregulated supply, determine:
 - (i) The regulated output voltage **1mk**
 - (ii) The value of series resistance R **3mks**

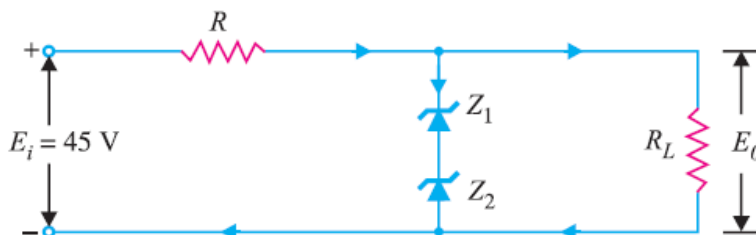


Figure 2

QUESTION 2 (20 MARKS)

- a) Outline any three properties of Semiconductors **3mks**
- b) Using a well labeled diagram, describe the formation of N type and P type semiconductors **8mks**

- c) Using the band theory of solids, highlight the major differences between conductors, semiconductors and insulators **9mks**

QUESTION 3 (20 MARKS)

- a) Derive the relation between β and α **6mks**
 b) For the circuit shown in Figure 3 , find:
 (i) the output voltage
 (ii) the voltage drop across series resistance
 (iii) The current through Zener diode. **9mks**

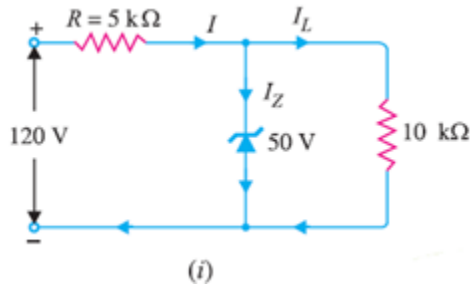


Figure 3

- c) The forward characteristic of a diode is shown in Figure 4. Use the characteristic to determine
 (i) the current flowing in the diode when a forward voltage of 0.4V is applied, **1mk**
 (ii) the voltage dropped across the diode when a forward current of 9mA is flowing in it, **1mk**
 (iii) the DC forward resistance of the diode when the forward voltage is 0.6V, and **2mks**
 (iv) Whether the diode is a Ge or Si type. **1mk**

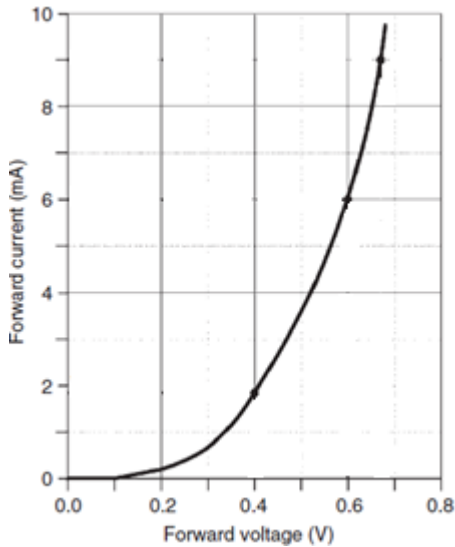


Figure 4

QUESTION 4 (20 MARKS)

- a) In the Wien bridge oscillator shown in Figure5, $R_1 = R_2 = 220 \text{ k}\Omega$ and $C_1 = C_2 = 250 \text{ pF}$. Determine the frequency of oscillations. **4mks**

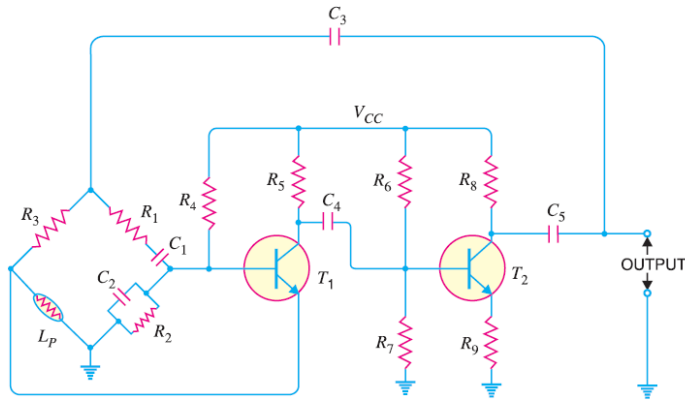


Figure 5

- b) Determine the (i) operating frequency and (ii) feedback fraction for Collpitt's oscillator shown in Figure 6 **8mks**

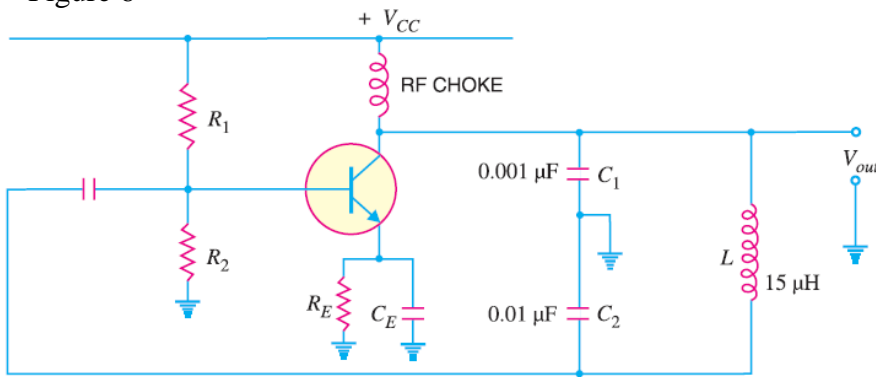


Figure6

- c) In the circuit diagram shown in Figure 7 if $V_{CC} = 12V$ and $R_C = 6 k\Omega$, draw the d.c. load line. What will be the Q point if zero signal base current is $20\mu A$ and $\beta = 50$? **8mks**

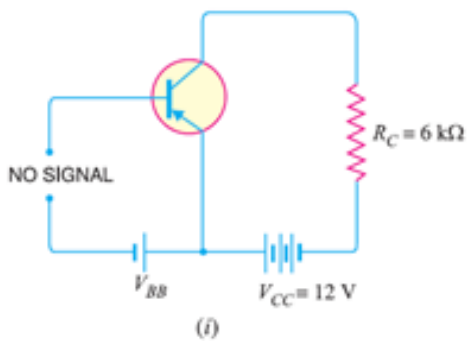


Figure7

QUESTION 5 (20 MARKS)

- a) Determine the maximum operating frequency for the circuit shown in Figure 8. The slew rate is $0.5 V/\mu s$. **5mks**

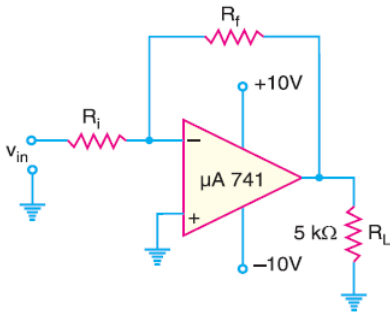


Figure 8

b) Determine the output voltage for the summing amplifier shown in Figure 10.

5mks

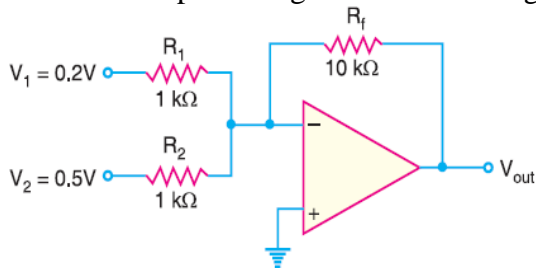


Figure 9

c) The differential amplifier shown in Figure 12 has a differential voltage gain of 2500 and a CMRR of 30,000. A single-ended input signal of $500 \mu\text{V}$ r.m.s. is applied. At the same time, 1V , 50 Hz interference signal appears on both inputs as a result of radiated pick-up from the a.c. power system.

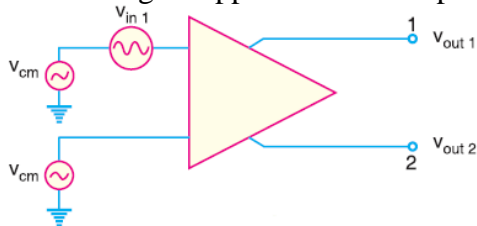


Figure 10

- (i) Determine the common-mode gain.
- (ii) Express the CMRR in dB.
- (iii) Determine the r.m.s. output signal.
- (iv) Determine the r.m.s. interference voltage on the output.

10mks