NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

BACHELOR OF ELECTRONIC ENGINEERING (HONS) DEGREE

Supplementary Examination August 2011 TEE 2111 — **Analogue Electronics**

Duration of Examination 3 Hours

Instructions to Candidates:

1. Answer any **five** questions only.
2. All questions carry equal marks.
3. Show all your steps clearly in any calculation.
4. Start the answers for each question on a fresh page.

Question 1

(a) The circuit values in figure 1 are R_1=33 kΩ,R_2=10 kΩ, R_C=2.2k ,R_E= 1 kΩ and V_{CC}=18 V.A silicon NPN transistor is used with β =100.Find the base working current I_{BQ}, ,the collector working current I_{CQ} and the collector emitter working voltage V_{CEQ}.

(15 marks)

(b) A thermistor is used for temperature stabilization ,what type of thermistor would it be .Re-draw the circuit with the thermistor . (5 marks)

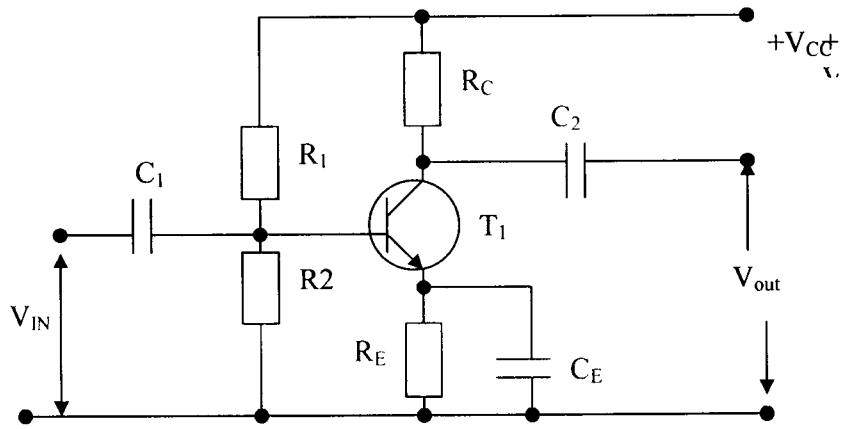


Fig 1

Question 2

For the feedback amplifier shown in fig 2 assume that A_v=100 determine:

(i) the overall voltage gain of the amplifier

(ii) the input impedance Z_{if}

(iii) the output impedance Z_{of}

(iv) What effect if any does the negative feedback has on the bandwidth of an amplifier. (20 marks)

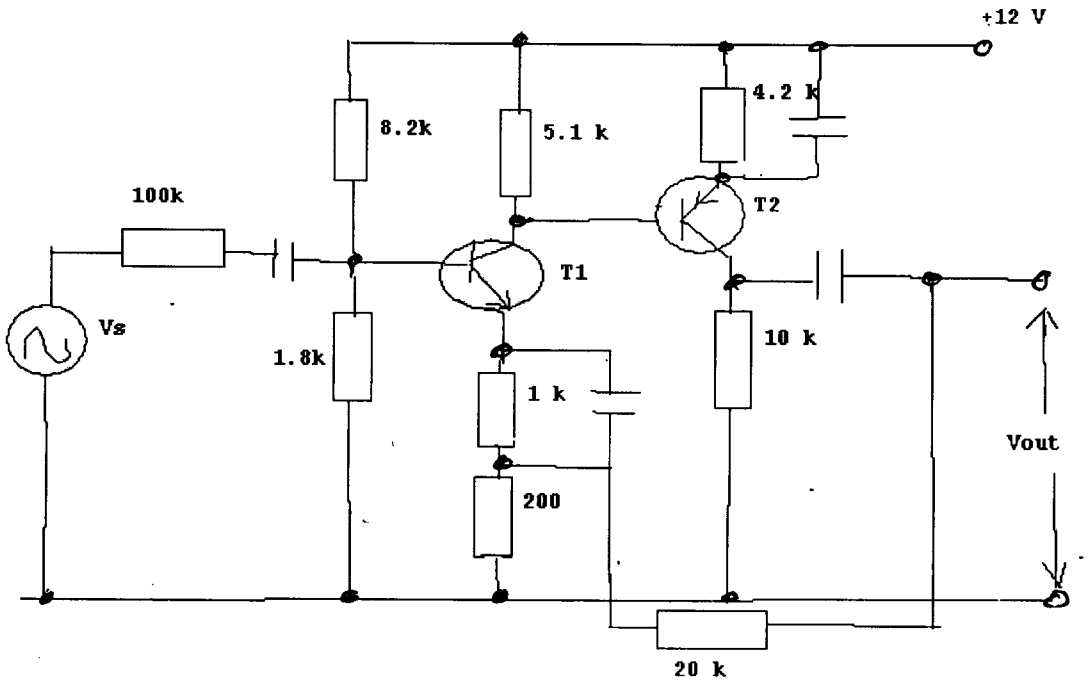


Fig 2

Question 3

For the circuit shown in fig 3

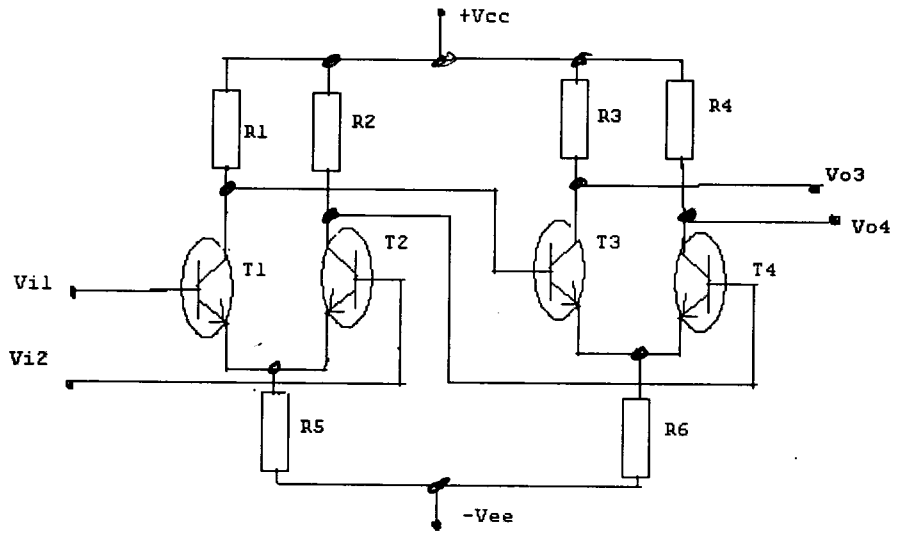


Fig 3

(a) Draw the half equivalent circuit that would be used to calculate the differential voltage gain. (6 marks)

(b) Give the expression that would be used to find the differential input resistance.(2 mark)

(c) Give the expression used to calculate the differential voltage gain . (4 marks)

(d) Draw the half equivalent circuit that would be used to find the common mode equivalent circuit. (6 marks)

(e) Give the expression of the common mode input resistance for the circuit. (2 marks)

Question 4

In integrated circuit techniques the following circuits are used .Show the arrangement of each circuit when used.

(i) Level shifting with emitter follower. (4 marks)

(ii) Voltage level-shifting with zener diode (4 marks)

(iii) Temperature compensated bias circuit. (4 marks)

(iv) Current mirror circuit. (4 marks)

(v) Current source circuit which is not temperature dependent. (4 marks)

Question 5

(a) Draw the circuit diagram of a basic step up and a basic step down switching regulator.

For each circuit give the expression for the output voltage. (10 marks)

(b) Determine the minimum and the maximum output voltage for the LM317 regulator shown in

Figure 4 below given that I_{ADJ} =100μA (6 marks)

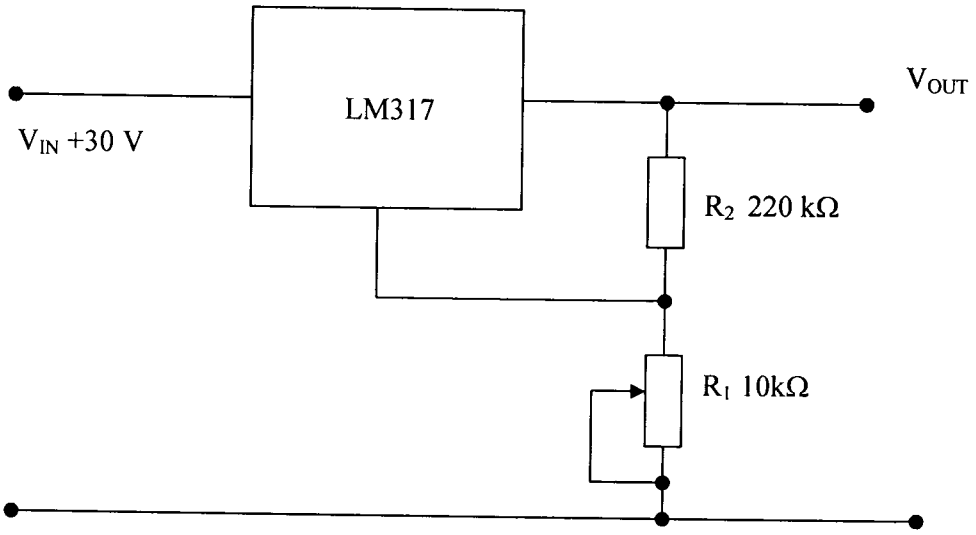


Fig 4

(c) A 78XX series three terminal regulator with external transistor and current limiting is used in a power supply ,show the circuit connection of the regulator. (4 marks)

Question 6

With the help of characteristics differentiate between the output and transfer characteristics of a MOSFET in the depletion mode, enhancement mode use some numerical values in your characteristics Draw the circuit symbol of each MOSFET. (20 marks)

Question 7

(a) Find the current I_1 in the circuit in fig 5. (4 marks)

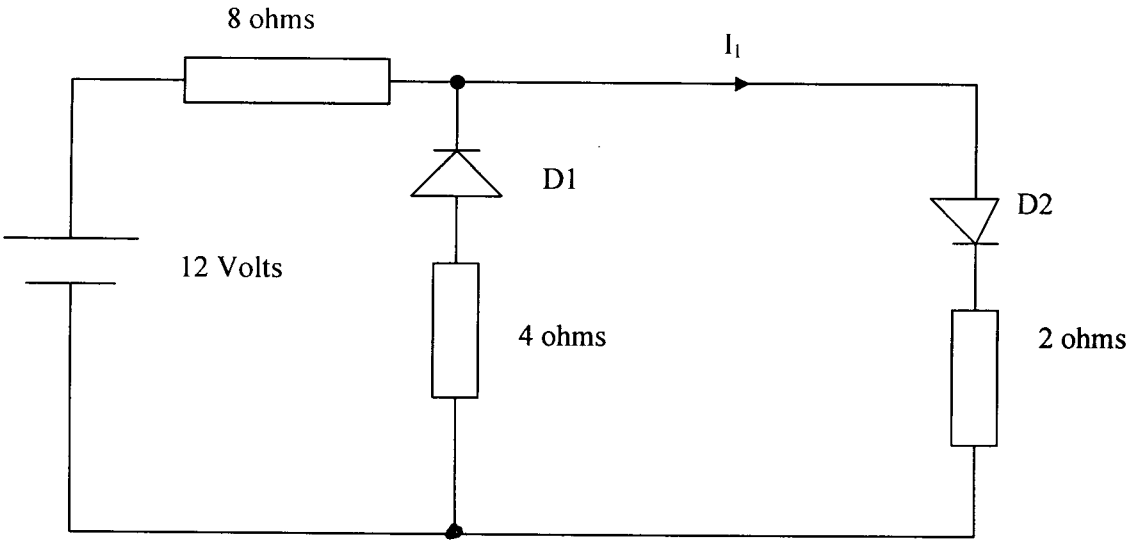
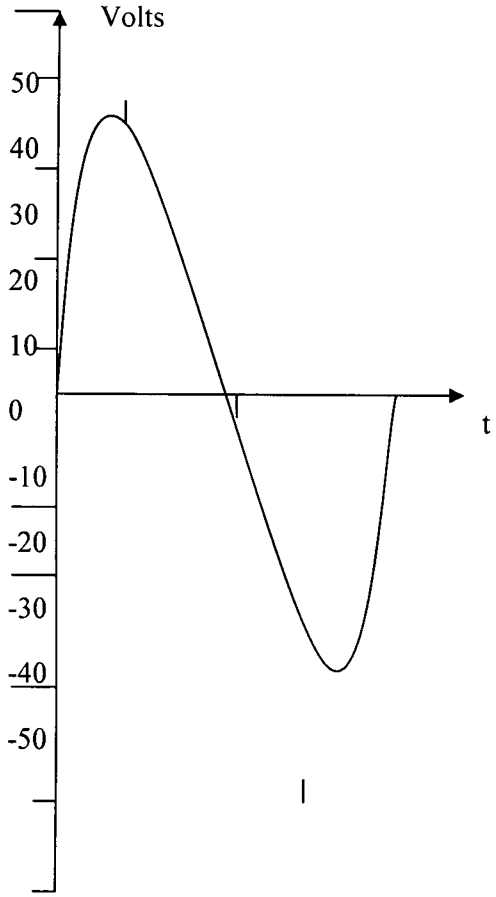


Fig 5

(b) A 80 volts peak to peak ac voltage supplies the input of the circuit in fig 6 .Sketch the output waveform at the point marked V_{OUT} .(4marks)



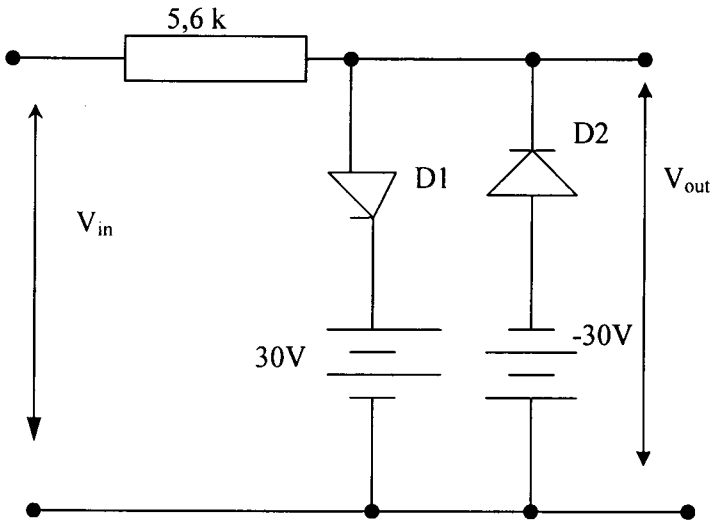
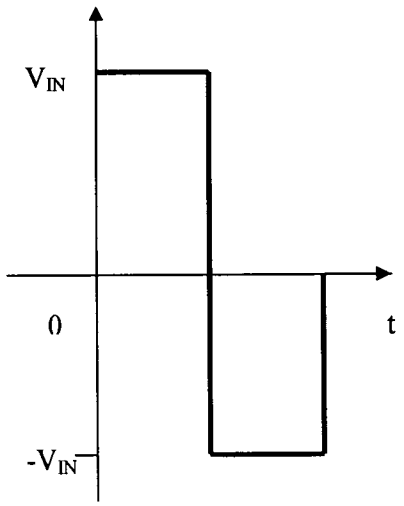
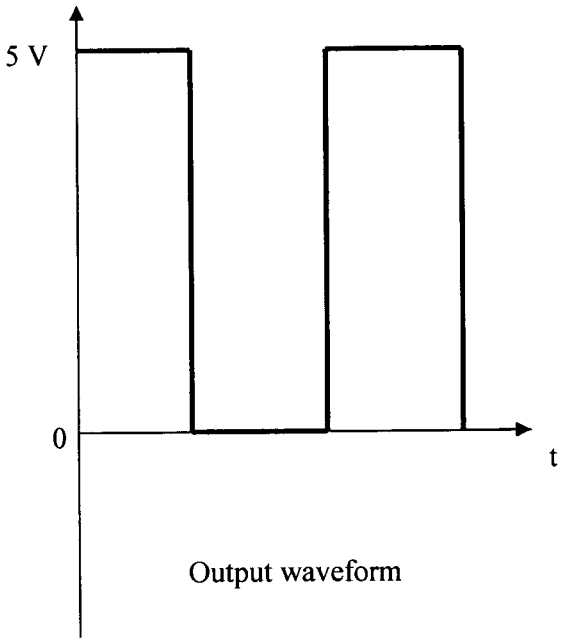


Fig 6

(c) Design a circuit that will produce the output waveform that is shown at the output of the black box when a the shown waveform is applied at the input terminals in fig 7. What is the name of the circuit designed. (6 marks)



Input waveform



Output waveform

Fig 8

(e) State the names of two materials that are mostly used in making semiconductors. (2 marks)

Question 8

(a) Draw a typical circuit that can be used as a CMOS gate . (5 marks)

(b) For an N-channel JUGFET I_{DSS} is 9 ma, V_P is minus 3,5 Volts and V_{GS} is minus 2 Volts. For the JUGFET calculate the value of the drain current I_D ,the value of g_{mo} and the value of g_m. (5 marks)

(c) A zener diode is used with a series resistor R_s= 20 ohms ,V_Z =18 Volts and a load resistor of R_L = 200 ohms .Draw the circuit of the stabilized power supply. The input varies from 20 Volts to 30 Volts.

(i) Calculate the minimum and the maximum currents of the zener diode (3 marks)

(ii) Determine the minimum and the maximum power that is

dissipated in the zener diode . (3 marks)

(iii) The minimum rated power dissipation in the series resistor R_s .. (4 marks)