PP1

TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION FOR:

Bachelor of Technology in Electrical and Electronic Engineering

TEE 4202 ANALOGUE ELECTRONICS I

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2024

TIME: 2 HOURS

DATE: AUGUST 2024

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** Questions; Attempt Question ONE and any other TWO Questions.

Do not write on the question paper.

Question ONE (Compulsory 20 marks)

a) Using energy level diagrams describe the following electronic materials
   i) Insulator
   ii) Conductor
   iii) Semiconductor **(3 marks)**

b) i) Explain why silicon transistors are more popularly used than Germanium transistors
   ii) Explain what is meant by **thermal runaway**
   iii) State the two effects of thermal runaway in transistor amplifiers
   iv) State any TWO methods of overcoming thermal runaway **(8 marks)**

c) Explain how the following types of breakdown occurs in diodes
   i) Zener Breakdown
   ii) Avalanche Breakdown **(4 marks)**

d) For the rectifier circuit of Figure Q1d, the voltage drop across the diode is 0.7,the input voltage is as shown, determine
   i) the peak output voltage
   ii) the average (dc)voltage
   iii) dc current **(5 marks)**

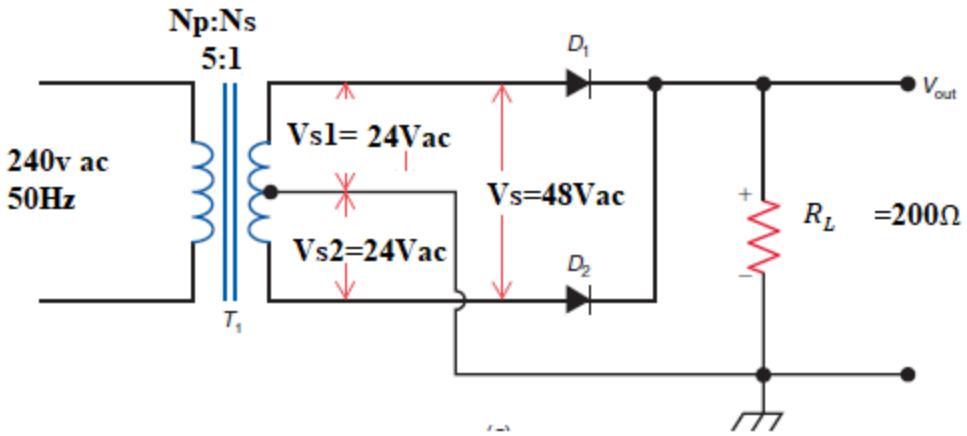

Figure Q1d

Question TWO

a) Explain the following terms**;**
   i) Doping ii) diffusion iii) drift **(3marks)**

b) With the aid of circuit diagram and waveforms, describe the operation of full wave rectifier **(7 marks)**

c**)** Draw a circuit diagram of a zener shunt regulator and explain the operation under the following situations;
   i) increased input voltage supply
   ii) decreased load current **(5marks)**

d) A 9V,0.5W zener diode having a minimum current of 5mA is used in a shunt regulator to supply a constant load current of 15mA from a supply voltage which varies between 18V to 24 V, Calculate;
   i) a suitable value of the series resistor and its power rating
   ii) the power dissipated by the zener when the supply voltage is maximum **(5 marks)**

Question THREE

a) **i)** Explain any TWO advantages of FETS over the BJTs
   ii) Explain any TWO limitations of self bias circuit when used to design FET amplifiers **(4 marks)**

b) For the circuit of Figure Q3b, the Q point is given as I_{DQ} = 2.4mA and V_{GSQ} = -2.0V, determine the following;
   i) V_G ii) V_D iii) V_S iv) V_{DS} v) V_{DG} **(5 marks)**

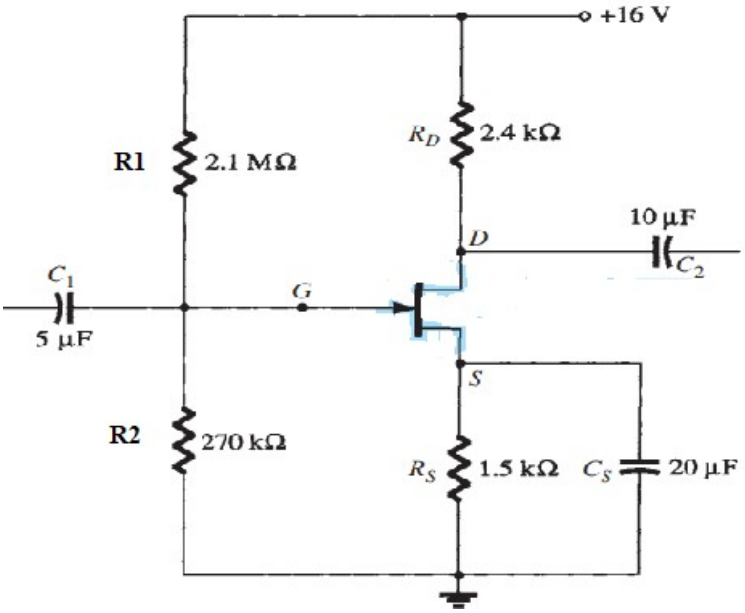

Figure Q3b

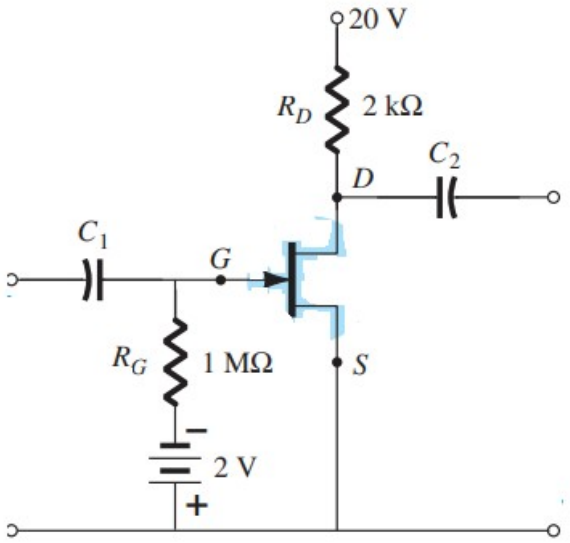

Figure Q3c

c) For the circuit of Figure Q3c, the operating point is defined by V_{GSQ} =-2V, I_{DQ}=5.625mA. Given that I_{DSS}= 10mA and pinch off voltage V_P=-8V, output admittance y_{os}= 40mS.Determine

i) Transconductance g_m

ii) drain to source resistance r_d

iii) Input impedance Z_i

iv) Output impedance Z_o

v) Voltage gain A_v **(5marks)**

d) With the aid of a diagram, describe the operation of n channel JFET. **(6 marks)**

Question FOUR

a) With the aid of a diagram, explain the operation of PNP transistor **(6 marks)**

b) Show that the common emitter current gain β is related to the common base current gain (α) by;

$$\beta = \frac{\alpha}{1-\alpha}$$ **(4 marks)**

c) i) Explain any TWO reasons for the fall of voltage gain at low frequencies for an RC-coupled amplifier

ii) State any ONE advantage and any ONE disadvantage of transformer coupled amplifiers **(4 marks)**

d) i) For the common emitter amplifier of Figure Q4c, draw the h-parameter equivalent circuit

ii) In the circuit of Figure Q4c the h-parameters of the transistor are; h_{ie}=1.5kΩ h_{fe}=80 h_{oe} =2x10^{-5}S $h_{\Re}$=0, Given that R_1 = 100 kΩ, R_2 =20 kΩ , R_C=5 kΩ

R_E= 470Ω C_E =47 μF and V_{CC}=12V, Calculate for the stage;

I) the input resistance II) the output resistance

III) the current gain IV) the voltage gain **(6marks)**

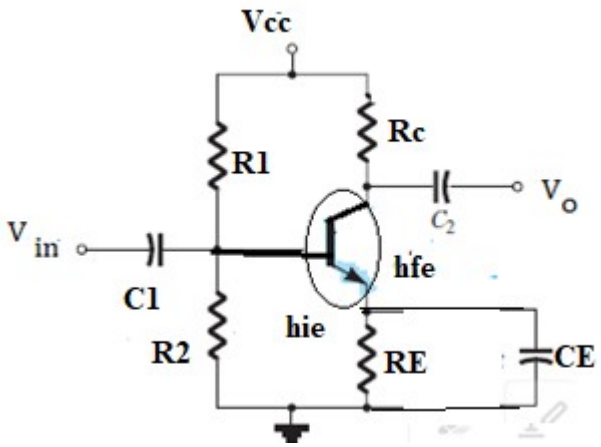

Figure Q4c

Question FIVE

a) i) Distinguish between positive and negative feedback

ii) State any TWO advantages and any ONE disadvantage of Negative feedback

iii) Draw a block diagram of a negative feedback amplifier and derive the overall Voltage gain with feedback **(10 marks)**

b) For the circuit of Figure Q5b

i) Explain how negative feedback occurs in the circuit

ii) Identify the type of negative feedback employed

iii) State the effect of this type of feedback on input and output resistance

iv) State any ONE application of the circuit

v) Estimate the voltage gain of the amplifier with feedback **7marks)**

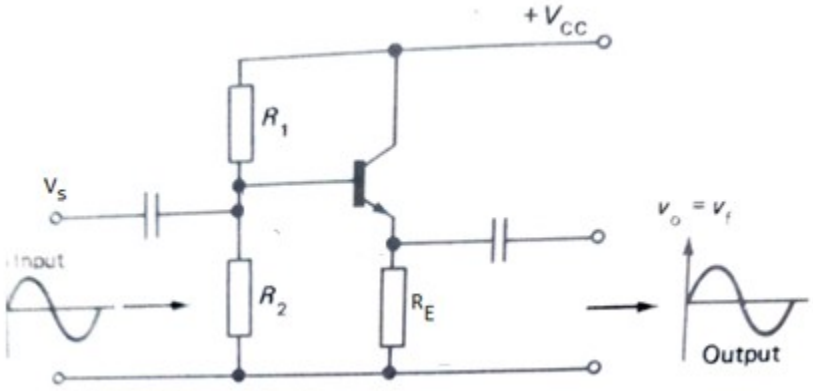

Figure Q5b

c) An amplifier without feedback has an input resistance of 1kΩ, a current gain of 100 and feeds a load of 5kΩ, determine

i) Voltage gain without feedback

ii) the voltage gain when series voltage feedback is applied such that 2% of the output voltage is fed back to the input **(3marks)**