



# TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

## UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN ELECTRICAL AND ELECTRONIC ENGINEERING

TEE 4205: ANALOGUE ELECTRONICS II

## SPECIAL/SUPPLEMENTARY EXAMINATION

**SERIES:** JULY, 2025

**TIME:** 2 HOURS

**DATE:** JULY, 2025

### Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of FIVE questions. Question ONE is Compulsory attempt any other TWO questions.

**Do not write on the question paper.**

### Question ONE

- (a) Draw the equivalent circuit of an  $r_e$ -model of a common emitter configuration of an npn transistor.

(2

marks)

- (b) For the network of Fig.Q1 determine

(i)  $r_e$  (ii)  $Z_i$  (iii)  $Z_o(r_o = \infty)$  (iv)  $A_v(r_o = \infty)$

(11.5 marks)

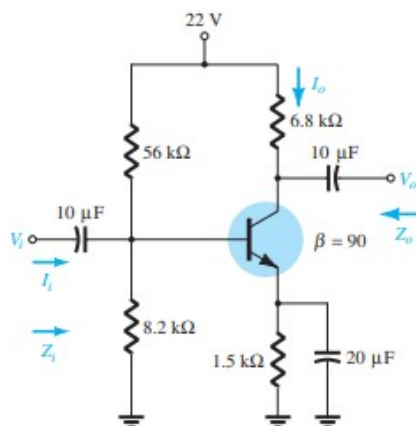


Fig.Q1

- (c) Consider h-parameters of a transistor as applied to small signal analysis
- State THREE reasons for the popular use of the parameters
  - Draw the h-parameter equivalent circuit of an npn transistor connected in common base configuration.
- (12 marks)**
- (d) (i) Describe feedback as applied to amplifiers in electrical circuits
- (ii) Name types of negative feedback. **(4 marks)**

## QUESTION TWO

- (a) (i) Explain the difference between dc and ac load line
- (ii) In a transistor amplifier, when the signal changes by 0.01 V, the base current changes by 10  $\mu\text{A}$  and collector current by 0.5 mA. If collect load  $R_c=2\text{ k}\Omega$  and  $R_L=5\text{ k}\Omega$ , find:
- Current gain
  - Input impedance
  - a.c load
  - Power gain.
- (9.5 marks)**
- (b) Consider a triac.
- Draw the schematic symbol.
  - With appropriate diagrams discuss the principle of operation.
  - Draw V-I characteristics.
- (10.5 marks)**

## QUESTION THREE

- (a) (i) With an appropriate diagram show how the voltage gain of an amplifier is affected by feedback.
- (ii) We have an amplifier of 60dB gain and has an output impedance  $Z_o=10\text{ k}\Omega$ . It is required to modify its output impedance to  $500\Omega$  by applying negative feedback.
- Calculate the feedback factor
  - Determine the percentage change in the overall gain, for 10% change in the gain of the internal amplifier.
- (14.5 marks)**
- (b) (i) Draw the circuit of emitter follower
- (ii) State its application. **(5.5 marks)**

## QUESTION FOUR

- (a) The following quantities are measured in CE amplifier circuit.
- With output a.c short-circuited (ie  $V_{ce}=0$ ),  $I_b=5\text{ }\mu\text{A}$ ;  $I_c=0.5\text{ mA}$ ,  $V_{be}=5\text{ mV}$
  - With input a.c open-circuited (ie  $I_b=0$ ).  $V_{be}=0.65\text{ mV}$ ;  $I_c=50\text{ }\mu\text{A}$ ;  $V_{ce}=0.5\text{ V}$ .
- Determine ALL the four h-parameters. **(6 marks)**
- (b) (i) Draw the a.c equivalent circuit of FET
- (ii) In an FET amplifier, the load resistance  $R_L=10\text{ k}\Omega$ ,  $R_G=1\text{ M}\Omega$ ,  $R_S=1\text{ k}\Omega$ ,  $C_S=25\text{ }\mu\text{F}$ . The FET used has  $\mu=25$ , and  $r_d=80\text{ k}\Omega$ . If the input signal voltage is 0.1 V at a frequency of 1 kHz, find the output signal voltage of the amplifier. **(9.5 marks)**
- (c) Given  $\beta=120$  and  $I_E=3.2\text{ mA}$  for common emitter configuration with  $r_o=\infty\text{ }\Omega$ . Determine
- $Z_i$

- (ii)  $A_v$  if load of  $2\text{ k}\Omega$  is applied
- (iii)  $A_i$  with the  $2\text{ k}\Omega$  load.

**(6 marks)**

#### **QUESTION FIVE**

(a) For an n-channel FET  $I_{DSS} = 6.5\text{ Ma}$ ,  $V_p = -2\text{V}$ ,  $V_{GS} = -1\text{V}$ . Find the values of

- (i)  $I_D$
- (ii)  $g_{mo}$
- (iii)  $g_m$

**(4.5 marks)**

(b) Consider Unijunction Transistor (UJT)

- (i) Draw the schematic and circuit symbol
- (ii) With the aid input characteristics describe its principle of operation
- (iii) State TWO of its applications.

**(13.5 marks)**

(c) State TWO advantages of negative feedback.

- (i) State TWO of its properties
- (ii) State TWO of its applications.

**(2 marks)**