PP2

TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATION

BACHELOR OF SCIENEC IN ELECTRICAL AND ELECTRONIC ENGINEERING

EEE 4205: ANALOGUE ELECTRONICS I

END OF SEMESTER EXAMINATION

SERIES: JULY 2025

TIME: 2 HOURS

DATE: Pick DateSelect MonthPick Year

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 and any other **THREE** Questions

Each question carries 20 marks

Do not write on the question paper.

QUESTION 1

(a) Differentiate between degenerative and regenerative feedback. **(4 marks)**

(b) State FOUR major merits of negative feedback in amplifiers **(4 marks)**

(c) With the help of a suitable block diagram, show that the feedback voltage gain A_f for an amplifier with Negative feedback is given by: $A_f = \frac{A}{1+A\beta}$ *where A is the open loop voltage gain and ß the feedback ratio.* **(6 marks)**

(d) An amplifier has an open loop voltage gain of 60 dB. When negative feedback is applied the gain reduces to 40 dB. Determine the feedback ratio, β in percentage. **(6 marks)**

QUESTION 2

(a) With the help of well a labeled diagram, describe the construction of n-channel MOSFET. Draw its schematic symbol. **(6 marks)**

(b) Describe and sketch the following characteristics of Bipolar Junction transistors

i. Input characteristics

ii. Transfer characteristics

(4 marks)

(c) For the BJT amplifier in Fig. Q2 given that: $R_1 = 82\ k\Omega$, $R_2 = 15\ k\Omega$, $R_C = 3.3\ k\Omega$, $R_E = 1\ k\Omega$, $\beta = 100$ and $V_{CC} = 18\ V$,

i. derive the expression for the d.c base current I_B
ii. Calcuate the dc, collector-emitter voltage V_{CE}

(10 marks)

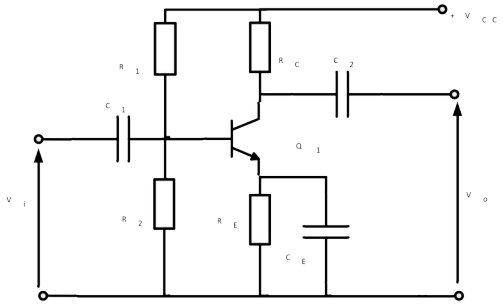

Fig. Q2.

QUESTION 3 (20 marks)

(a) Describe the properties and applications of the following semiconductor devices. In each case draw its schematic symbol.
(i) Light emitting diode
(ii) Varactor diode

(4 marks)

(b) Describe with the help of suitable diagram and waveforms, the operation of a full-wave centre-tap rectifier hence derive the expression for its average d.c voltage. **(8 marks)**

(c) Calculate the average d.c voltage of a *full-wave* rectifier if it is connected to the U.S domestic socket (120 V, 60 Hz) via a stepdown transformer with turns-ratio of 1:10.
(Assume the diode barrier voltage $V_d = 0.7\ V$) **(8 marks)**

QUESTION 4

(a) Describe using suitable circuit and waveforms the filtering process in a half-wave rectifier. **(8 marks)**

(b) State THREE advantages of bridge rectifier over full-wave centre-tap rectifier. **(3 marks)**

(c) Determine in Fig Q4 the current through R_1, D_1 and R_L given that $V_i = 12\ V$, $R_L = 2\ k\Omega$, $R_1 = 0.5\ k\Omega$ and the diode's Zener breakdown voltage $V_Z = 9V$. **(9 marks)**

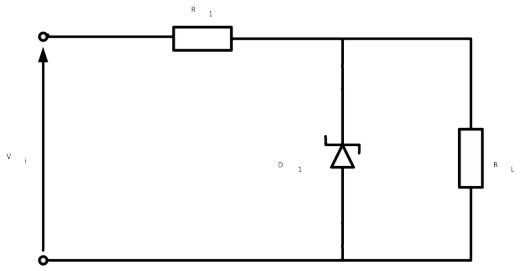

Fig. Q4

QUESTION 5

(a) Describe with the help of suitable diagrams THREE bipolar junction transistor amplifier configurations stating TWO major properties of each configuration. **(9 marks)**

(b) State the THREE major requirements of a small signal amplifier. **(3 marks)**

(c) For Fig.Q5, given $I_{DSS} = 10\ mA$, $V_P = -2V$, $R_G = 10\ M\Omega$, $R_S = 0.5\ k\Omega$, $R_D = 2\ k\Omega$, $V_{DD} = 20\ V$

i. Determine using graphical method the gate-source voltage V_{GS}

ii. Calculate the d.c drain-source voltage V_{DS}.

(8 marks)

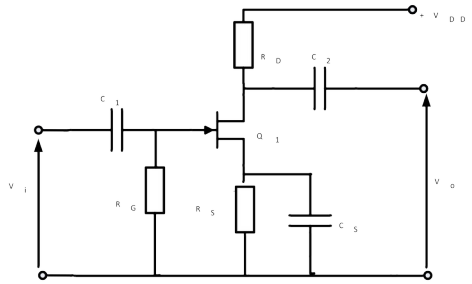

Fig. Q5