

**UNIVERSITY OF SWAZILAND
MAIN EXAMINATION 2012**

FACULTY OF SCIENCE

**DEPARTMENT OF ELECTRICAL AND ELECTRONIC
ENGINEERING**

TITLE OF PAPER : ANALOG DESIGN II / ANALOGUE ELECTRONICS II

COURSE NUMBER : EE323 / E442

TIME ALLOWED : THREE HOURS

INSTRUCTIONS

1. Read each of the FIVE questions carefully
2. Answer any FOUR questions.
3. Each question carries 25 marks
4. Marks for each section are shown on the right-hand margin

THIS PAPER HAS SIX PAGES INCLUDING THIS PAGE.

**THIS PAPER IS NOT TO BE OPENED UNTIL PERMISSION HAS BEEN GIVEN BY
THE INVIGILATOR.**

QUESTION No. 1

- (a) (i) What is a feedback circuit?
[2marks]
- (ii) Derive an expression for the gain of a negative voltage feedback amplifier.
[8marks]
- (b) (i) With the aid of a neat diagram describe the action of an emitter follower.
[5marks]
- (ii) What is Darlington Amplifier?
[3 marks]
- (c) When negative voltage feedback is applied to an amplifier of gain 100, the overall gain falls to 50.
- (i) Calculate the fraction of the output voltage feedback.
[3marks]
- (ii) If this fraction is maintained, calculate the value of the amplifier gain required if the overall stage gain is to be 75.
[4 marks]

QUESTION No. 2

- (a) (i) What is an oscillator? [2marks]
- (ii) With the aid of a neat diagram, explain the operation of a tank circuit. [8 marks]
- (b) (i) Why do we use three RC sections in an RC oscillator? [3marks]
- (ii) With the aid of a neat circuit diagram, explain the circuit operation of a phase shift oscillator and name three advantages of a phase shift oscillator. [9marks]
- (c) In the phase shift oscillator circuit,
 $R_1 = R_2 = R_3 = 1\text{M}\Omega$ and $C_1 = C_2 = C_3 = 68\text{pF}$.
Calculate the frequency at which the circuit oscillates. [3 marks]

QUESTION No. 3

- (a) A power amplifier supplies 50W to an 8-ohm speaker. Find
- (i) the a.c. output voltage.
 - (ii) the a.c. output current.

[4 marks]

- (b)
- (i) Classify power amplifiers according to their mode of operation.
 - (ii) Draw the circuit of a class A power amplifier.
 - (iii) Explain the operation of class A and class B power amplifiers in terms of their a.c. load lines.

[13 marks]

- (c) A class A transformer coupled power amplifier has zero signal collector current of 50mA. If the collectors supply voltage is 5V, find:

- (i) The maximum a.c. power output
- (ii) The power rating of transistor
- (iii) The maximum collector efficiency

[8 marks]

QUESTION No. 4

(a) (i) What is a multivibrator? [2marks]

(ii) Explain the principle on which it works. [4 marks]

(b) With a neat sketch, explain the working of an astable multivibrator. [13 marks]

(c) In the astable multivibrator, $R_2 = R_3 = 10\text{K}\Omega$ and $C_1 = C_2 = 0.01\mu\text{F}$. Determine the time, period and frequency of the wave it produces. [6 marks]

QUESTION No. 5

- (a) (i) List the different types of Field Effect Transistors. [3marks]
- (ii) Explain the construction and working of a JFET. [10 marks]
- (b) Write short notes on the following:
- (i) Advantages of JFET [3marks]
- (ii) Difference between JFET and Bipolar Junction Transistor [3 marks]
- (c) In a self-biased n-channel JFET circuit, the operating point is to be set at $I_D = 1.5\text{mA}$ and $V_{DS} = 10\text{V}$. The JFET parameters are $I_{DSS} = 5\text{mA}$ and $V_P = -2\text{V}$. Calculate the values of R_S and R_D , given that $V_{DD} = 20\text{V}$. [6 marks]