TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

UNIVERSITY EXAMINATION 2017/2018

BACHELOR OF SCIENCE IN MEDICAL ENGINEERING

EEE 4231: ANALOGUE ELECTRONICS I (PAPER 2)

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: SEPTEMBER 2018

TIME: 2 HOURS

DATE: SEPTEMBER 2018

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 (Compulsory)** and any other **TWO Questions**

Do not write on the question paper.

QUESTION 1 (compulsory-30 marks)

(a) Describe the characteristics of a p-n junction when forward biased. **(4 marks)**

(b) Explain what you understand by the term *small signal amplifier.* Describe any THREE requirement of a small signal amplifier. **(8 marks)**

(c) Describe with the help of suitable diagram and waveforms, the operation of a bridge rectifier hence derive the expression for its average d.c voltage. **(10 marks)**

(d) Calculate the secondary voltage of a transformer required to produce a d.c voltage of 12V in a *bridge* rectifier. *(Take the diode depletion voltage $V_d = 0.7$ V).* **(8 marks)**

QUESTION 2

(a) With the help of well labeled diagram, describe the construction and principle of operation of MOSFET. **(6 marks)**

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

i. Input characteristics
ii. Output characteristics

(6 marks)

(c) For the BJT amplifier in Fig. Q2, draw h-parameter a.c equivalent circuit hence determine its a.c voltage gain given that: $R_1 = 82\ k\Omega$, $R_2 = 15$, $R_C = 3.3\ k\Omega$, $R_E = 1\ k\Omega$, $h_{fe} = 100$ and $h_{ie} = 2\ k\Omega$

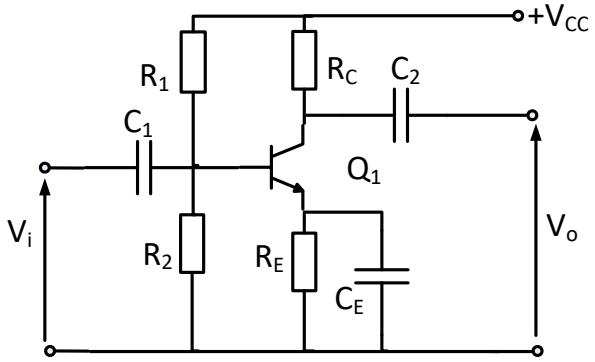

Fig. Q2. **(8 marks)**

QUESTION 3

(a) Describe using suitable circuit and waveforms filtering process in a half-wave rectifier. **(6 marks)**

(b) Describe the advantages of bridge rectifier over full-wave centre rectifier. **(6 marks)**

(c) Determine in Fig Q3 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 $V_Z = 9$V.

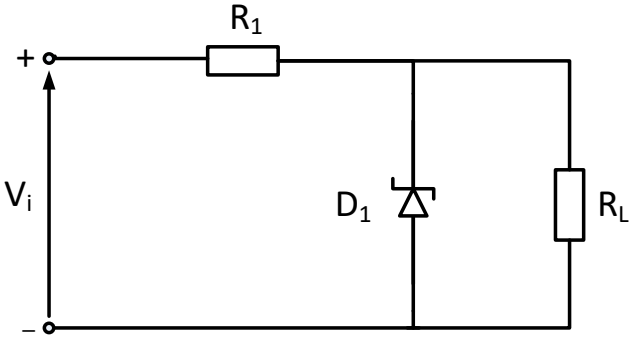

Fig. Q3

(8 marks)

QUESTION 4

a) Differentiate between negative and positive feedback and describe FOUR major merits of negative feedback in amplifiers. **(12 marks)**

(b) With the help of 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. **(4 marks)**

(c) An amplifier has an open loop voltage gain of 60 db. When negative feedback is applied the gain reduces to 50 db. Determine the feedback ratio (β). **(4 marks)**

QUESTION 5

(a) Describe using suitable circuit and waveforms how the rectified voltage from a half-wave rectifier is filtered. **(8 marks)**

(b) Describe a varactor diode and state its major application. **(4 marks)**

(c) The current-voltage characteristic of a diode is given by the table below:

Forward voltage V_F (V)	0.05	0.10	0.15	0.20	0.25	0.30
Forward current I_F (mA)	0	0.4	0.6	4.0	30	200

Plot the characteristic and use it to determine

i. The d.c resistance at I_F = 100 mA.
ii. The a.c resistance at I_F = 20 mA.

(8 marks)