TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

UNIVERSITY EXAMINATION 2017/2018

BACHELOR OF TECHNOLOGY IN MEDICAL ENGINEERING

TEE 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 THREE major differences between BJT and FET amplifiers. **(6 marks)**

(b) Describe the characteristics and application of a zener diode. **(6 marks)**

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

(d) A half-wave rectifier connected to transformer produces d.c voltage of 9 V. Determine the secondary voltage of the transformer. *(Take V_d for the diode = 0.7 V)* **(8 marks)**

QUESTION 2

(a) Describe and sketch the following bipolar junction transistor characteristics

i. Input characteristics

ii. Output characteristics

(6 marks)

(b) Briefly describe the properties of the following components and in each case draw its symbol and state its main application in electronics circuits.

i. Varactor diode
ii. Light emitting diode
iii. Photo diode

(6 marks)

(c) Determine the d.c collector-emitter voltage V_{CE} for the circuit of **Fig. Q2** given that:

$R_B = 240\ k\Omega$, $R_C = 2.2\ k\Omega$, $\beta = 50$, $V_{CC} = 12$ V. (Take $V_{BE}=0.7V$).

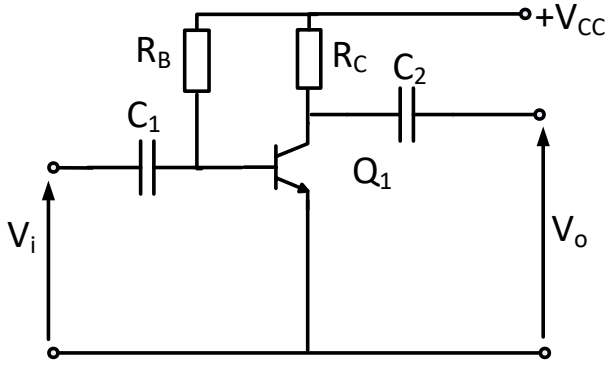

Fig. Q2

(8 marks)

QUESTION 3

(a) Describe using suitable circuit and waveforms the 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.

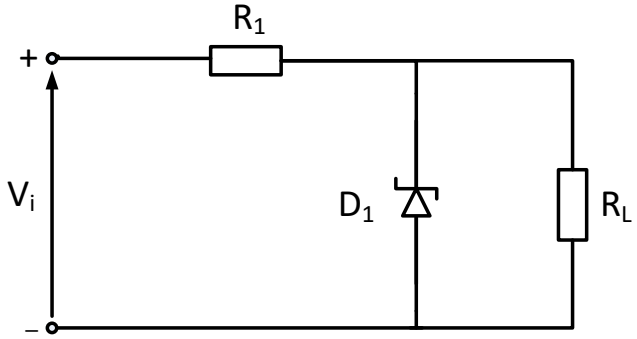

Fig. Q3

(8 marks)

QUESTION 4

(a) State the type of feedback represented in Fig Q.4. Give reasons for your answer. **(6 marks)**

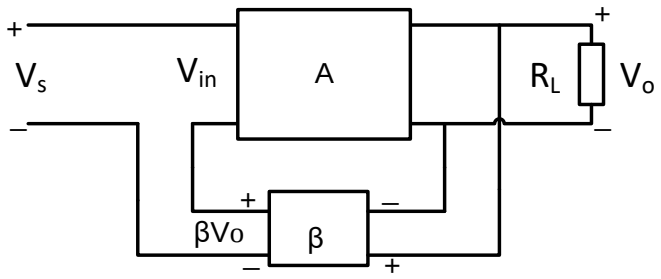

Fig. Q4.

(b) Explain the effect of the feedback in (a) on the amplifier's voltage gain, input impedance and output impedance. **(8 marks)**

(c) Calculate the output signal voltage V_O if the signal voltage V_S = 100 mV and open-loop voltage gain $A = -100$ and feedback factor $\beta = 25\%$. **(6 marks)**

QUESTION 5

(a) Describe using suitable block diagram the principle of operation of MOSFET. **(6 marks)**

(b) State the FOUR major requirements of a small signal amplifier. **(4 marks)**

(c) Draw the a.c equivalent circuit for FET amplifier of **Fig.Q5**. Determine its a.c voltage gain given that: I_{DSS} = 12 mA, V_P = -6V, R_G = 10 MΩ, R_D = 4 kΩ and the operating point is defined by V_{GS} = -2V

NB: mutual conductance g_m is given by: $g_m = g_{m0}\left(1 - \frac{V_{GS}}{V_P}\right)$ where $g_{m0} = \frac{2I_{DSS}}{|V_P|}$ **(10 marks)**

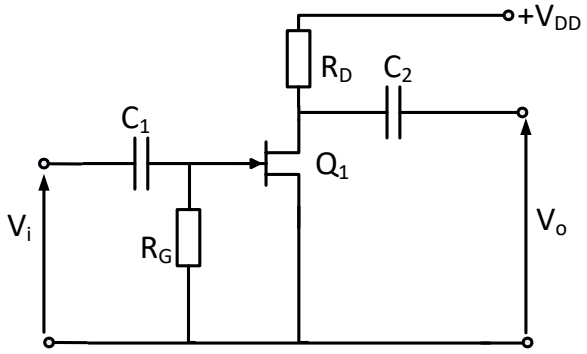

Fig. Q5.