UNIVERSITY OF RUHUNA - FACULTY OF TECHNOLOGY
BACHELOR OF ENGINEERING TECHNOLOGY
Level 2 (Semester 1) Examination, October 2018

COURSE UNIT: ENT2113 ANALOGUE ELECTRONIC SYSTEM
Time Allowed: 3 hours

Note: Answer all **four (05)** questions
All symbols have their usual meaning

Question 01

(a) State the Thevenin's theorem and Norton's theorem.

(b)

i. The Thevenin equivalent circuit of a network consists of a voltage of 9 V in series with an impedance of 2Ω. Find the Norton equivalent of circuit.

ii. The Norton equivalent circuit of a network consists of a 12A in parallel with an impedance of 3Ω. Find the Thevenin equivalent of circuit.

(c) **Figure Q01(c)** represents an active network consisting of one voltage source, one current source and four linear resistors. Find the,

i. Thevenin equivalent circuit,

ii. Norton equivalent circuit, at the terminals A and B.

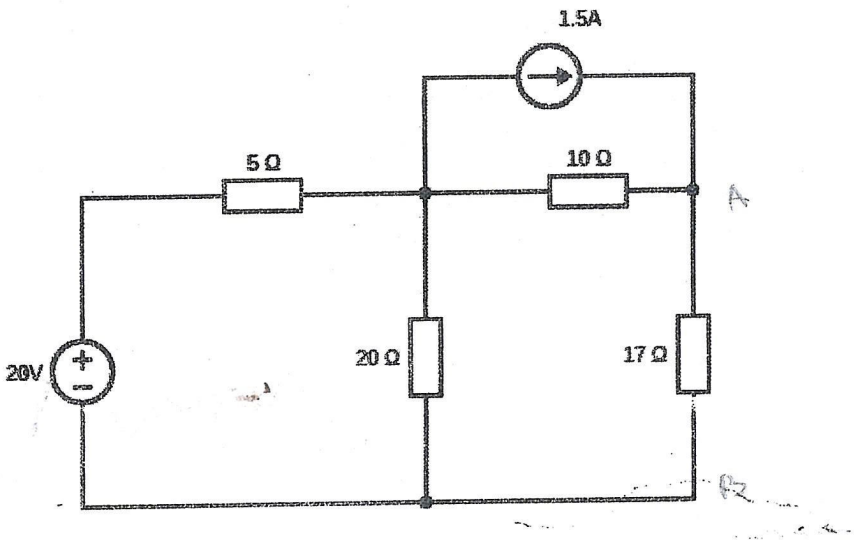


Figure Q01(c)

(d) **Figure Q01(d)** shows a Wheatstone bridge, R_1 is a fixed 1kΩ resistor, R_3 can be adjusted in 1Ω steps from 0 to 1100Ω, and R_2 can be selected to be 1k Ω, 10k Ω, 100k Ω or 1M Ω

i. Suppose that the bridge is balanced with R_3=732Ω and R_2=10kΩ. What is the value of R_x?

ii. What is the largest value of R_x which the bridge can be balanced?

iii. Suppose that R_2=1MΩ. What is the increment between values of R_x for which the bridge can be precisely balanced?

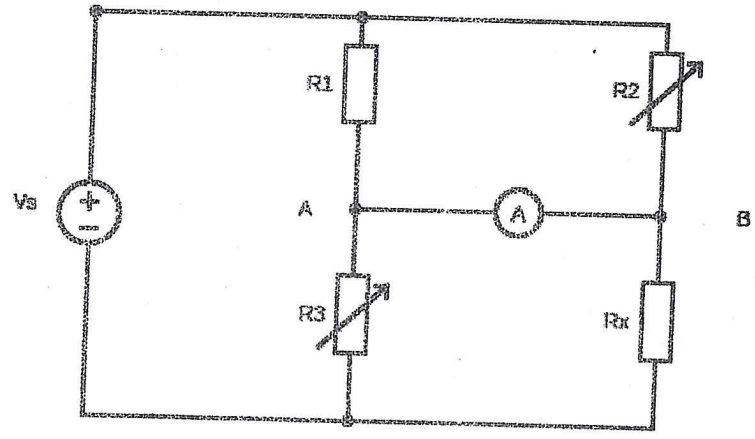


Figure Q01(d)

Question 02

(a) Draw the circuit symbol and V-I characteristics of a diode.

(b) What are the half wave and full wave rectification methods, explain it using circuit diagrams.

(c) Draw the circuit symbol and V-I characteristics of a typical zener diode.

(d) The load resistance R_L in the voltage regular circuit of **Figure Q02(d)** is fixed at 10kΩ. But the input supply voltage V_i varies from 80V to 120V.

i. Does zener remain "on" even when the input supply voltage reduces to 80V?

ii. Calculate the maximum value of zener diode current.

iii. Calculate the minimum value of zener diode current.

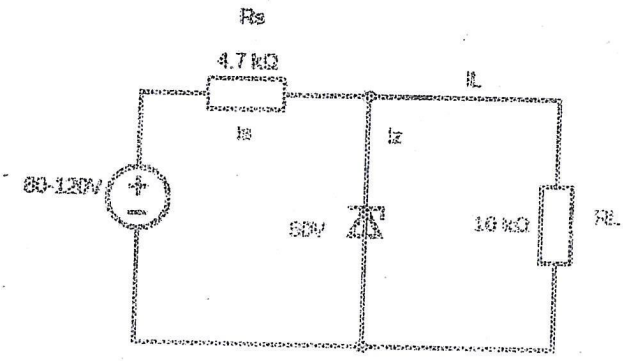


Figure Q02(d)

Quection 03

(a) Name the three Biploar Junction Transistor(BJT) configurations used in the circuit, and draw circuit diagrams to show each of them using a npn transistor.
(b) Draw the input and output charactiristics of a BJT for Common Emmieter(CE) configuration.
(c) List three applications of a transistor and briefly explain each of them.
(d) Consider the common emitter transistor amplifier as shown in figure Q03 (d)
    I. Using Thevenin's equivalent circuit, calculate the quiescent voltage and current.
    II. Is this amplifier non-inverting or inverting?

Where: V_{cc}=12V, V_{BE}=0.6V, R_1=15kΩ, R_2=2.7kΩ, R_C=1kΩ, R_E=220Ω, β=100

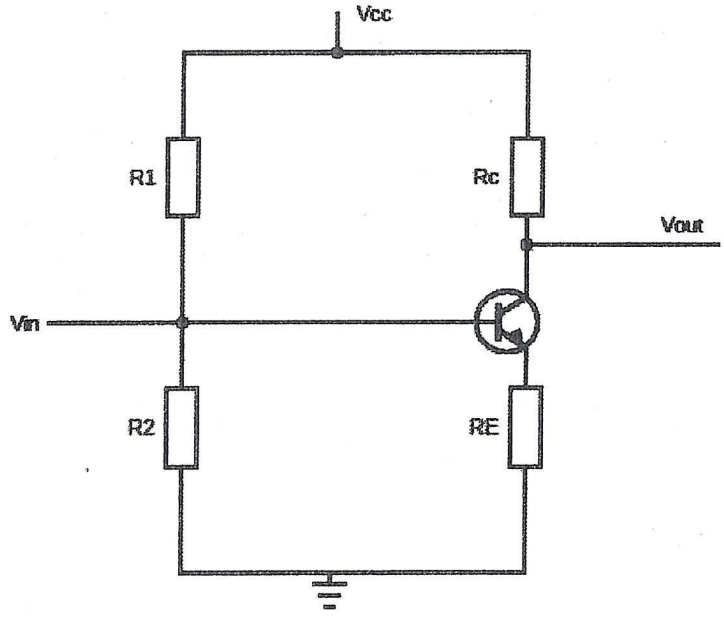


figure Q03 (d)

Question 04

a) We use semiconductors to build Field Effect Transistor (FET).Show how those different types of Semiconductors are connected to form FET. Give the circuit symbol of different types of the FET.
b) Show the different regions of operation of a FET on its Drain characteristics.
c) A certain JFET indicate that I_{DSS}=3.0mA, V_{GS}(off)=(-6V)maximum, and gfs(max)=500μS.Using these values, determine the forward trans conductance for V_{GS}=(-4V),and find I_D at this point.

d) In a self-bias N-channel JFET shown in figure Q04 (d) the operating point is to be set at I_d=1.5mA and V_{ds} = 10V. The JFET parameters are I_{DSS} = 5 mA and V_P = (-2V). Find the values of R_S and R_g
(Given that V_{dd} = 20V.)

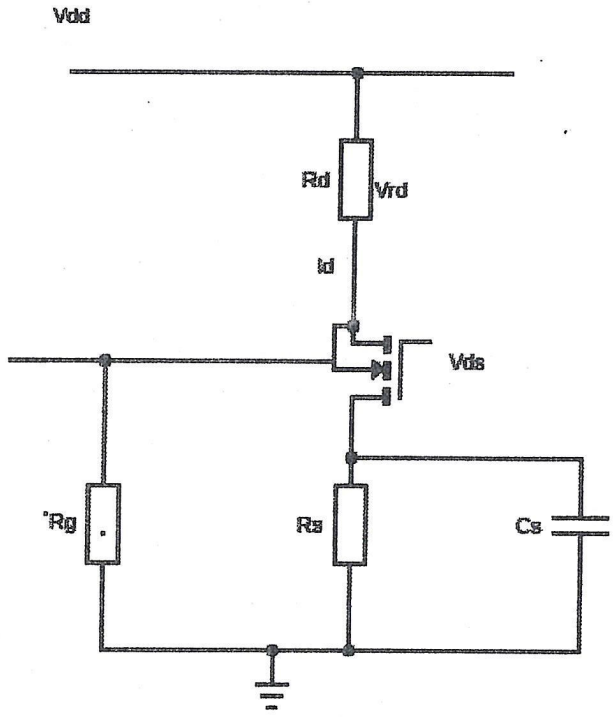


figure Q04 (d)

Question 05

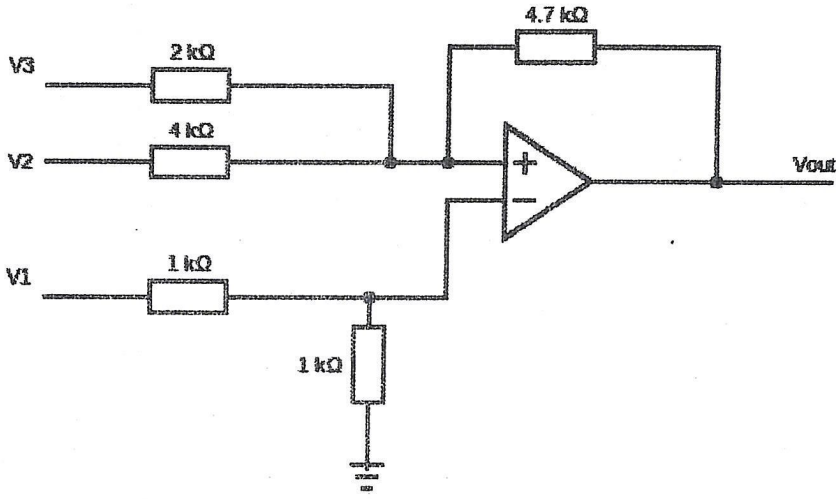
(a) List four characteristics of an ideal operational amplifier (Op-Amp). Compare the ideal values with its typical values.

(b)

I. What are the benefits of negative feedback in an O-Amp circuit?
II. Why is it necessary to reduce the gain of an Op-Amp from its open loop gain?
III. What do you mean by the term "Virtual ground"?
IV. Derive an equation for the closed loop voltage gain for a non-inverting amplifier.
V. What is a voltage follower? Explain it using a circuit diagram and find the voltage gain of it?

(c) Describe the three basic filters and respond characteristic.

(d) Determine an expression for the output voltage V_{out} in the circuit shown in figure Q05(c). Assume that the operational amplifier is ideal.
(If V_2=3V and V_3=2V, then find the value of V_1 to get V_{out} =0V.)



figureQ05(c)