The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Bachelor of Technology Honours in Engineering
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX3272 Applied electronics**
Academic Year	:	2014/2015
Date	:	26th of August 2015
Time	:	9.30am – 12.30pm
Duration	:	3 hours

General instructions

1. Read all instructions carefully before answering the questions
2. This paper consists of 8 questions. Answer five(5) questions only.

Question 01

(a) Describe Nodal and Mesh analysis.

(b) Find the mesh currents I_1 and I_2 in the circuit shown Figure Q1.a. Consider $R_1 = 30\Omega$, $R_2 = 15\Omega$, $R_3 = 10\Omega$, $V_1=150V$ and $V_2=100V$.

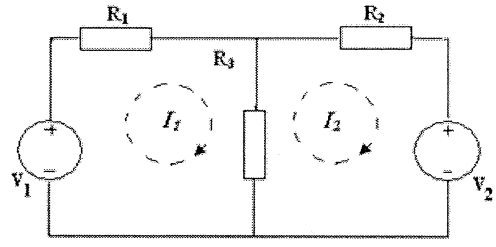


Figure Q1.a

(c) Find the Thevenin and Norton equivalent circuits for the two terminal circuit shown in Figure Q1 .b

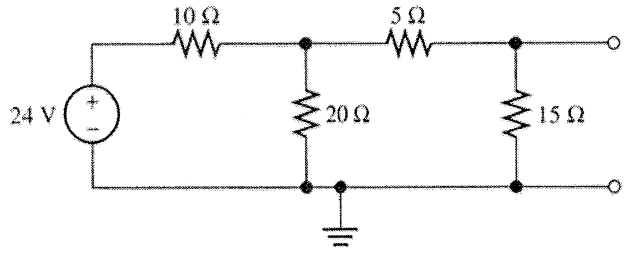


Figure Q1.b

Question 02

(a) Draw the transfer functions of the following filters and give a brief explanation of their operation, considering the cutoff frequency

a. Ideal lowpass filter
b. Ideal highpass filter
c. Ideal bandpass filter
d. Ideal notch filter

(b) Suppose that an input signal given by $v_{in}(t) = 5\cos(20\pi t) + 5\cos(200\pi t) + 5\cos(2000\pi t)$ is applied to the lowpass RC filter shown in Figure Q2. Find an expression for the output signal. Consider R_1 as $1000/2\pi\Omega$ and C as 10×10^{-6} F.

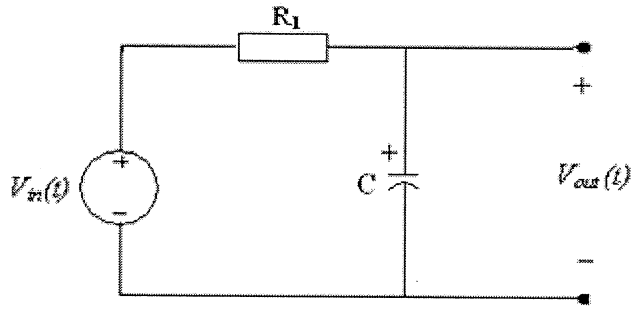


Figure Q2

Question 03

(a) Sketch the forward and reverse characteristic curve of a Diode. Identify the Leakage current and Breakdown voltage on the characteristic curve.

(b) It is required to produce a stabilized output of 10V from a nominal 15V supply using a regulated voltage supply circuit using a zener diode. Draw the circuit diagram, clearly labeling all the components.

(c) Figure Q3 shows a commercial Wheatstone bridge where 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 1kΩ, 10kΩ,100 kΩ or 1MΩ.

a. Suppose that the bridge is balanced with $R_3 = 366\ \Omega$ and $R_2 = 100$ kΩ. What is the value of R_x?
b. What is the largest value of R_x for which the bridge can be balanced?

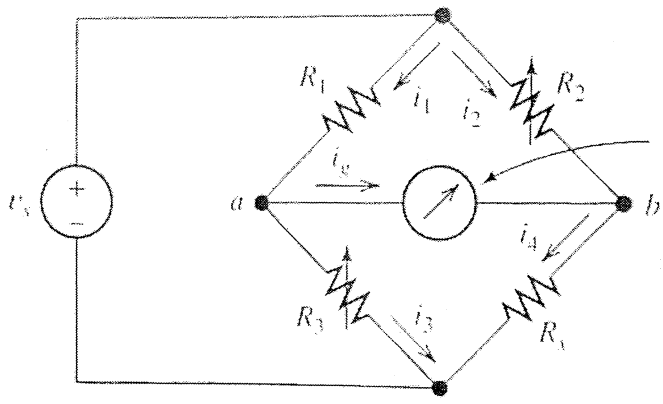


Figure Q3

Question 04

(a) Explain two biasing techniques used in Bipolar Junction Transistor(BJT) for Common Emitter(CE) configuration.

(b) Briefly explain at least two applications of Bipolar Junction Transistors. Discuss the configurations and characteristics of each of them.

(c) The silicon Bipolar Junction Transistor shown in Figure Q4 has a dc current gain of 75. If Vcc =20V, V_{BB}=6V and I_{CO} = 100nA Determine the I_B and R_B when Rc=1kΩ and V_{CE}=9V. Sketch the load line and show the Q point.

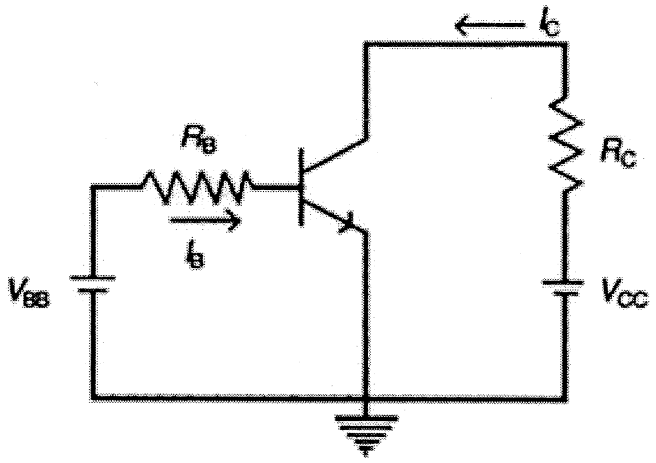


Figure Q4

Question 05

(a) List 3 characteristics of an ideal Op-amp

(b) Determine an expression for the closed loop voltage gain A_v for the circuit shown in Figure Q5. Assume that the Op-amp is an ideal one.

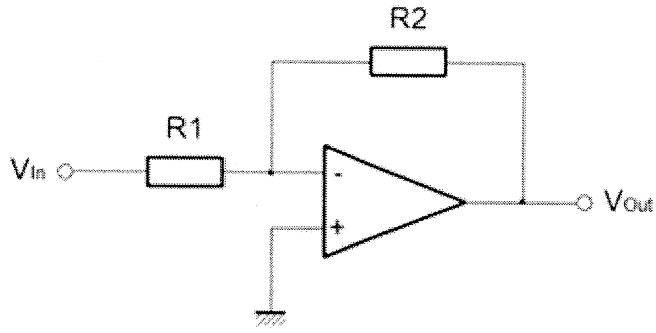


Figure Q5

(c) In a summing amplifier, the inputs at the inverting terminals are +6V, -3V and +3V respectively. The feedback resistance is 2kΩ, and all the resistances at the input terminals are 1kΩ.

a. Draw the circuit diagram for the above described amplifier
b. Determine the output voltage

Question 06

(a) Explain the operation of following using suitable diagrams

a. R-2R Ladder network
b. Bistable Multivibrator
c. Voltage follower

(b) Power semiconductor devices can be classified into three groups according to the nature of their controllability. What are they? How are they controlled?

(c) Briefly explain the difference between n-channel and p-channel JFETs

Question 07

(a) Simplify the following Boolean expression using a K-map.

$$X = \overline{A}B\overline{C} + \overline{A}\overline{B}C + A\overline{B}\overline{C} + A\overline{B}C + AB\overline{C} + ABC$$

Hint:- Indicate the grouping properly to gain marks for this question

(b) Simplify the following Boolean expression using Boolean theorems

$$X = (A + \overline{B})C + (B + \overline{C})A + \overline{A}\overline{B}$$

(c) A security system is operated using 3 switches A, B and C. It produces an alarm sound P for the following switch combination
If switch A or switch B is in the ON position and if switch C is in the ON position then a signal to sound an alarm, P is produced.
a. Write down the truth table for the above case
b. Construct the logic circuit for this system

Question 08

(a) What is the difference between Sequential logic and Combinational logic?

(b) The waveforms of the following figure are applied to a SR flip flop. Determine the Q output assuming that the positive edge-triggered SR flip flop is initially RESET.

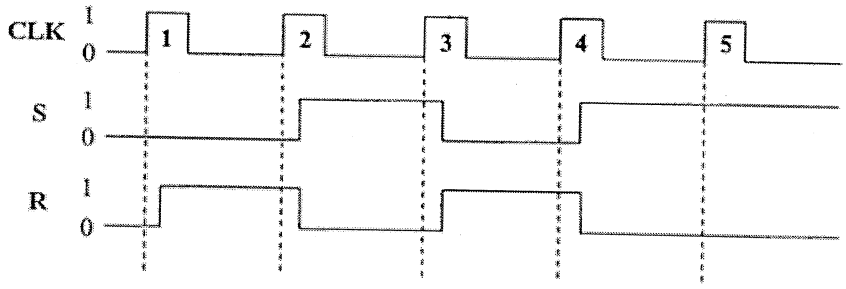


Figure Q8

(c) Design a 3 bit Synchronous up counter with the regular binary count sequence 0,1,2,3,4,5,6 and 7. Use SR Flip-Flops to design the circuit. Use only the six step method when building the circuit.

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