10-01-2019

MECE 347 Final

Name: Surname: Number: Signature:

Q1) The integrated circuit ICX given below has the following characteristics.



Va>=Vb Vx=Va-Vb

Vb>Va Vx=Vb-Va

For the circuit below where two ICX is used and input is Vin(t)=10 Sin(2πft) where f=0.25 Hertz R=1 Ohm.



1. Find Vo(t) and I(t). **(15 points)**
2. Draw Vin(t), Vo(t) and I(t) as a function of time. Give the important points in your plots **(7 points)**
3. Draw Vin(t) versus Vo(t). **(8 points)**

Q2) The integrated circuit ICX is given below has the following characteristics.



Vy>=Vx Vo=VCC

Vx>Vy Vo=Vaa

ICX is used in the circuit below where R=1 Ohm and Vin(t)=10 Sin(2πft) Volt, f=0.25 Hertz.



1. Draw Vin(t) and Vout(t) as a function of time ‘t’. **(8 points)**
2. Draw Vout(t) versus Vin(t). **(8 points)**
3. Some changes are made at the circuit above and new circuit is obtained. In this new circuit C=1 Farad and R=1 Ohm, Vcc=12 Volt and Vaa=-6 Volt. If initially Vx(0)=-3 Volt and Vout=12 Volt. Draw Vx(t) and Vout(t) as a function of time. Vx(t) and Vout(t) will be a periodical signal what will be the period of both signals. **(14 points)**



Q3) Draw the I-V characteristics of a Diac. **(2 points)**

Q4) Draw the I-V characteristics of a Tunel-Diode. **(2 points)**

Q5) Explain the functionality of the regulator circuit below: If Rl increases what happens. Explain all the changes in the circuit current and voltages, and explain how the output voltage Vout is regulated. **(6 points)**



Q6) A Phase-Shift with 3 RL stages is given below. Find mathematically and calculate the frequency that will result with undamped oscillations when the gain of FET is adjusted suitably and determine the gain of the FET amplifier at this condition. R1=R2=R3=1000 Ohm, L1=L2=L3=1 Henry. **(30 points)**

