

Ministry of Higher Education King Jahd University of Petroleum & Himerals Electrical Engineering Department



وزارة التعنيم المحالي جامعة الملك. فحهد للبنروك و المعادن قسم الهندسية الكهربائيية

INDUSTRIAL ELECTRONICS

First Major Exam

EE 445 – Winter 2008 (072)

Sunday, March 16th, 2008

20H00 - 21H30 (1 hour - 30 minutes)

Name

Student ID

Examiner - Dr. Alaa El-Din Hussein

- This exam contains three questions and is composed of 5 pages including this cover page. Partial point distribution is indicated between brackets. Please pace yourself accordingly.
- > This is a **CLOSED book** examination.
- Make sure to **state all assumptions** you find necessary to complete your answer.
- Show all your work. Partial credit will be given. If you think you need something that you can't remember, write down what you need and what you'd do if you remembered it.

Question #	Question 1	Question 2	Question 3	Total
Mark				
Total Mark	20	20	20	60

الظهران ٣١٢٦١ ● المملكة العربية السعودية ● تلفون : ٢٢٧٧-٢٢٧ (٢٠) ● فاكس : ٣٥٣٥–٣٥١ (٢٠) ● تلكس : ٨٠١٩٥٠ جافهد ● برقياً : الجامعة DHAHRAN 31261, SAUDI ARABIA • Telephone : (03) 860-2277 • Fax : (03) 860-3535 • Telex : 801060 KFUPM SJ • Cable : AL-JAMAAH

Question 1:

For the shown SCR circuit, the supply is a DC = 100V. The SCR has an I_{GT} of 20 mA. Assuming that the gate current can't be neglected.

- a) Calculate R₂ to cause a firing after 2ms from closing the switch. **[5 Marks]**
- b) If R_2 is set to be $1k\Omega$, calculate the firing delay after closing the switch. [5 Marks]
- c) What is the minimum and maximum delay that can be achieved by changing R₂. **[5 Marks]**
- d) Sketch the gate and capacitor currents for the case in part b and indicate all the critical levels. [5 Marks]



[20 Marks]

Question 2:

For the shown UJT relaxation oscillator, the unijunction transistor has the following characteristics η =0.5, r_{BB} =7 k Ω , V_v =1.5, I_P =5 μ A, and I_v = 4 mA. The supply voltage V_{cc} =15V.

- a) Calculate V_P. [2 Marks]
- b) Draw the voltage waveform across the capacitor $C_{E}.\ \mbox{[2 Marks]}$
- c) Drive an expression for the oscillation frequency. [6 Marks]
- d) Calculate the oscillation frequency. [2 Marks]
- e) Calculate the minimum and maximum frequency achieved by this circuit assuming the capacitor value is fixed at 0.1μ F. [6 Marks]
- f) What is the effect of changing η on the frequency of oscillation? [2 Marks]

[20 Marks]



Question 3:

For the shown 555 circuit the supply volatge $V_{\rm cc}$ is set to 15V.

- a) Draw the waveform at the trigger input and at the output. [4 Marks]
- b) Drive an expression for the frequency of oscillation. [8 Marks]
- c) Calculate the output frequency, and the duty ratio for the shown circuit. **[4 Marks]**
- d) What is the function of the control voltage pin?.[2 Marks]
- e) Suggest an application of this circuit using the control voltage input. [2 Marks]



[20 Marks]