

UNIVERSITY OF DUBLIN

TRINITY COLLEGE

Faculty of Engineering, Mathematics and Science

School of Computer Science and Statistics

**Integrated Computer Science Programme
Year 1 Annual Examination**

Trinity Term 2013

CS1025 – Electrotechnology

Thursday 2nd May 2013

Regent House

9:30 – 11:30

Dr. Eamonn O Nuallain

Instructions

- (i) A total of FOUR questions should be attempted.**
- (ii) All questions carry equal marks.**
- (iii) Use of non-programmable calculators and log tables is permitted.**
You must note the make and model of your calculator on your answer book.

Q1.

An electronic flash gun has a $2000\mu\text{F}$ storage capacitor. It is charged to 48 volts for action. The flash duration in use is $1/1000$ s.

- (i) Find the maximum charge on the capacitor and the maximum energy stored.

(10 Marks)

- (ii) Find the average current through the flash tube and the average power delivered to the tube during flashing.

(10 Marks)

- (iii) After the flash the capacitor must be recharged. How long does it take if the supply delivers a current of 100 mA.

(5 Marks)

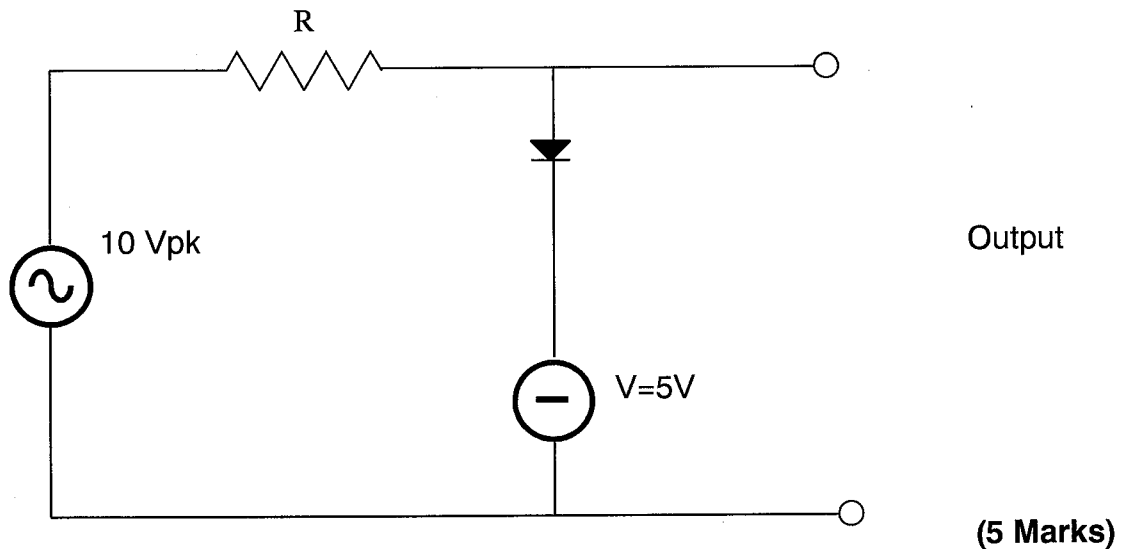
Q2.

Sketch the characteristic curve of the semiconductor diode. Explain the operation of the semiconductor diode with reference to this sketch.

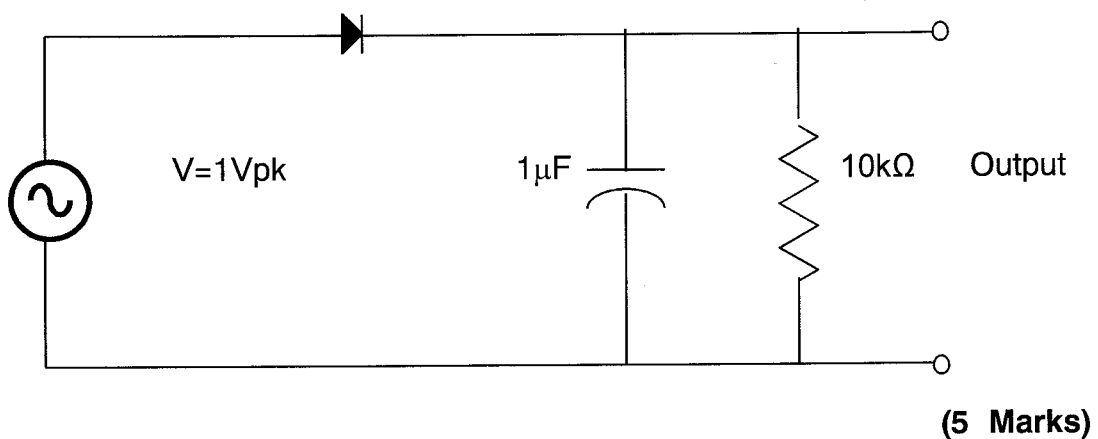
(10 Marks)

Assuming ideal sources and components (forward voltage drop of diode $\sim 0V$), sketch the outputs of the following circuits:

(i)



(ii)



(iii)

For this latter circuit, (ii), sketch (approximately) the output where the value of the capacitor is increased and decreased.

(5 Marks)

Q3.

Draw a diagram of the E-MOSFET. Sketch the drain current versus drain-source voltage for different gate-source voltages and explain the operation of this device with reference to this sketch.

(15 Marks)

For a drain feedback E-MOSFET amplifier the data sheet specifies $I_{D(on)} = 3mA$ for $V_{DS(on)} = 10V$. If $V_{DD} = 25V$ select a value of R_D that allows the MOSFET operate at the specified Q-point.

(10 Marks)**Q4.**

For an n-channel E-MOSFET the manufacturer specifies $v_{GS(th)} = 4V$ and $i_{DS} = 7.2mA$ at $v_{GS} = 10V$. For $v_{DD} = 24V$ and $R_G = 100M\Omega$ specify R_D for operation at $v_{DS} = 8V$.

(25 Marks)**Q5.**

- (i) Define Electric Field Strength.

(3 Marks)

- (ii) Compute the Electric Field Strength midway between two point charges of $30 \mu C$ and $40 \mu C$ when the charges are placed 10cm apart in air.

(10 Marks)

- (iii) State Ampere's Law for an infinite, straight current carrying wire.

(2 Marks)

- (iv) There exists an infinite straight wire carrying a current of 5.0A in the \hat{a}_y direction at $x = 2m$, $z = -2m$. Find the magnetic field strength at the origin.

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