

UNIVERSITY OF DUBLIN

TRINITY COLLEGE

Faculty of Engineering and Systems Sciences

Department of Computer Science

B.A.(Mod.) Computer Science
Junior Freshman Examination

Trinity Term

CS1025 – Electrotechnology

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Instructions

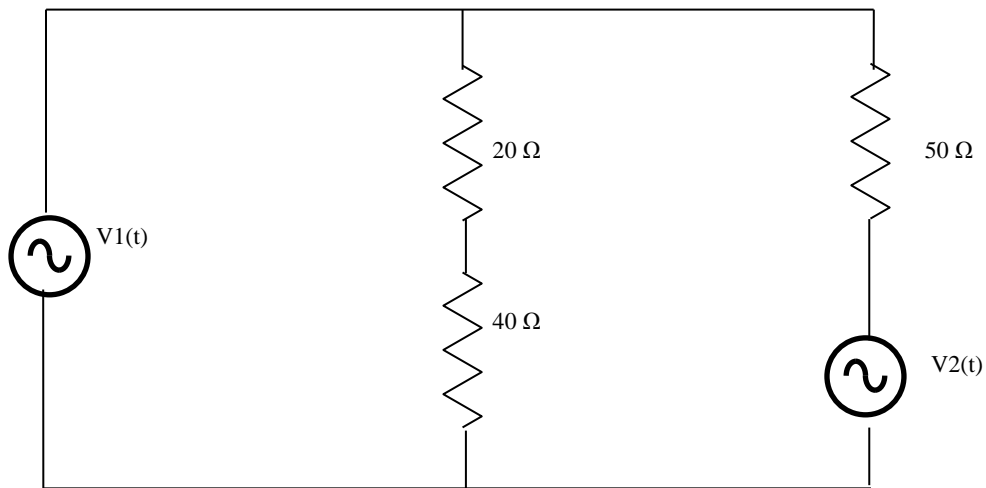
- (i) A total of TWO questions should be attempted.
- (ii) All questions carry equal marks.
- (iii) Use of non-programmable calculators and log-tables is permitted.
You must note the make and model of your calculator on your answer book.

Q1

(a) With reference to the circuit below, where $V_1=2V$, $V_2=5V$ determine:

- (i) The resistance as 'seen' by the supply in the leftmost branch (V_1).
- (ii) The current drawn from the supply in the leftmost branch (V_1).
- (iii) The resistance as 'seen' by the supply in the rightmost branch (V_2).
- (iv) The current in the rightmost branch
- (v) The current in the centre branch.

(5 X 5 Marks)



(b) What is the potential difference across two series inductors 50 mH and 120 mH, if the current in the circuit has a peak to peak value of 20 Amps, a frequency of 100 Hz and the magnitude of the current at time $t=0$ is 10 Amps.

(25 Marks)

Q2.

(a) Explain what is meant by semiconductor doping. Illustrate your answer with diagrams.

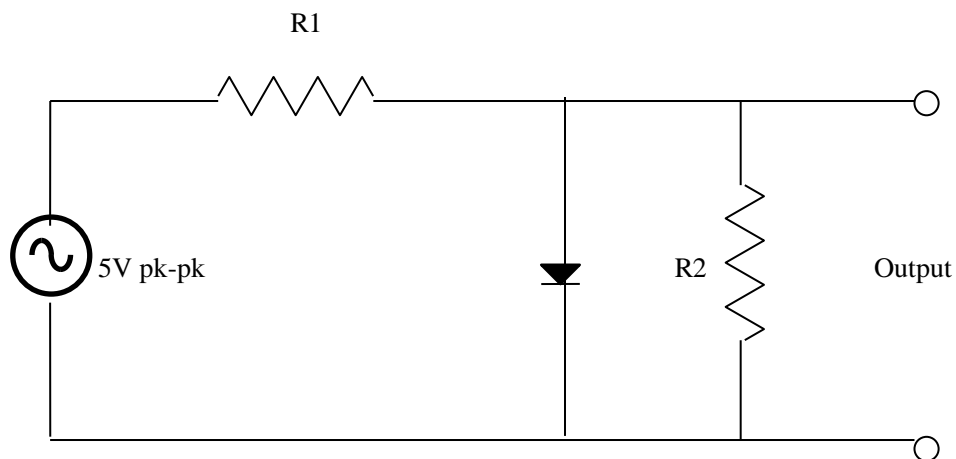
(10 Marks)

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

(10 Marks)

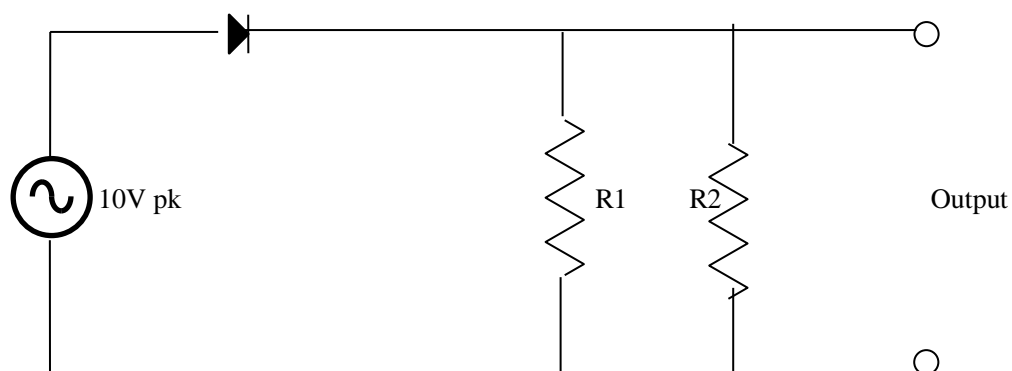
(c) Assuming ideal sources and components (forward voltage drop of diode $\sim 0V$), sketch the outputs of the following circuits:

(i)



(15 Marks)

(ii)



(15 Marks)

Q3.

- (a) Draw a diagram of the E-MOSFET. For 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.

(10 Marks)

- (b) 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.

(20 Marks)

- (c) 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 $V_{DS} = 8V$.

(20 Marks)

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