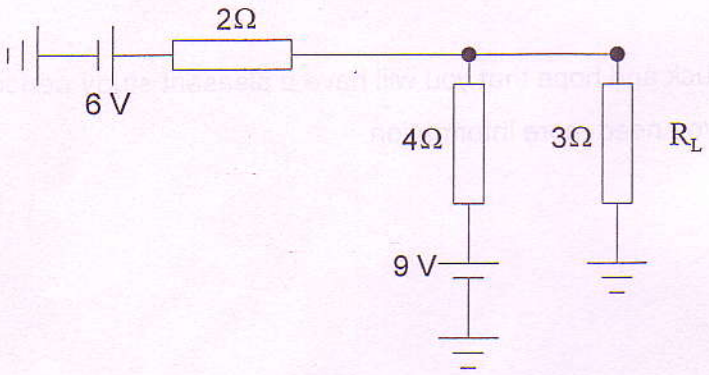
ASSIGNMENT 1

INDUSTRIAL ELECTRONICS N4

QUESTION 1

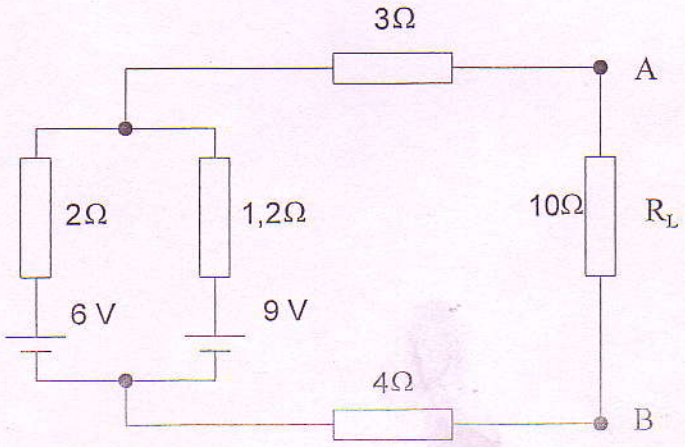
Determine the value of the current through R_L in the following diagram using Kirchoff's laws (only).



[10]

QUESTION 2

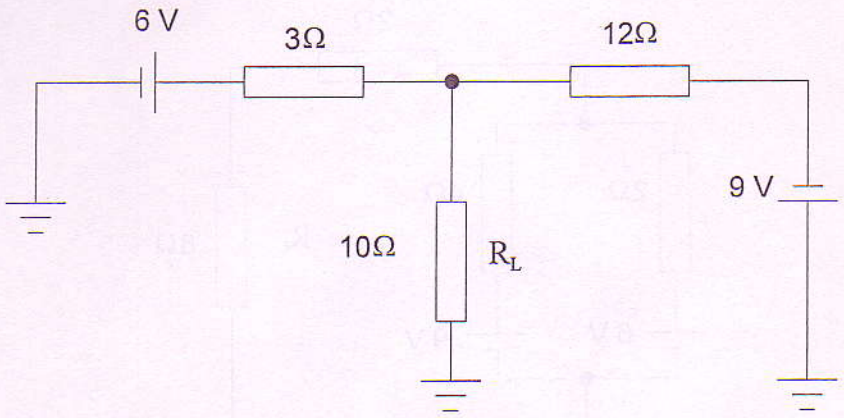
Use Thevenin's method to calculate the potential difference across R_L in the following figure.



[10]

QUESTION 3

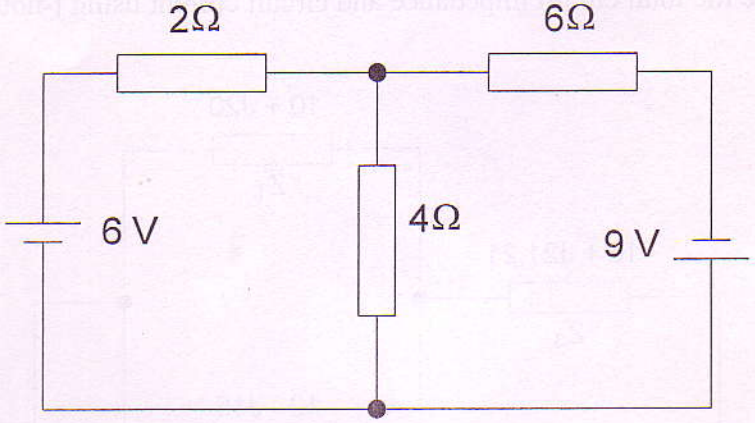
Use the superposition method to calculate the current flow through R_L in the following figure.



[10]

QUESTION 4

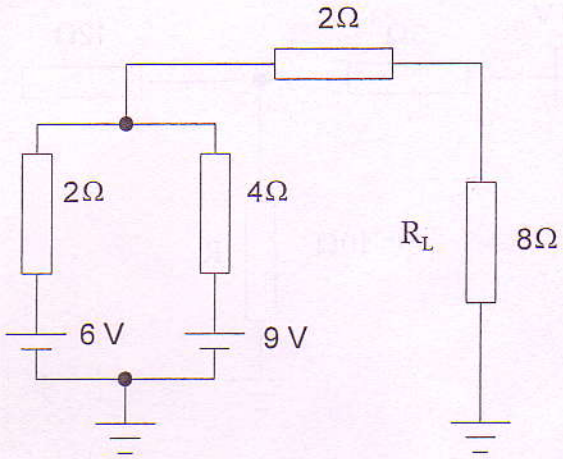
Use Thevenin's theorem to calculate the current through the 4 Ω resistor in the following diagram.



[10]

QUESTION 5

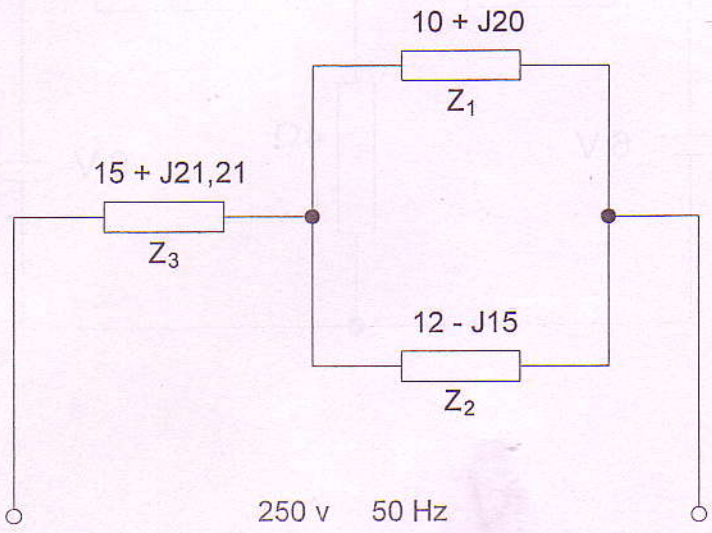
Use Thevenin's method to calculate the current flow through R_L in the following figure.



[10]

QUESTION 6

Calculate the total circuit impedance and circuit current using j-notation only.

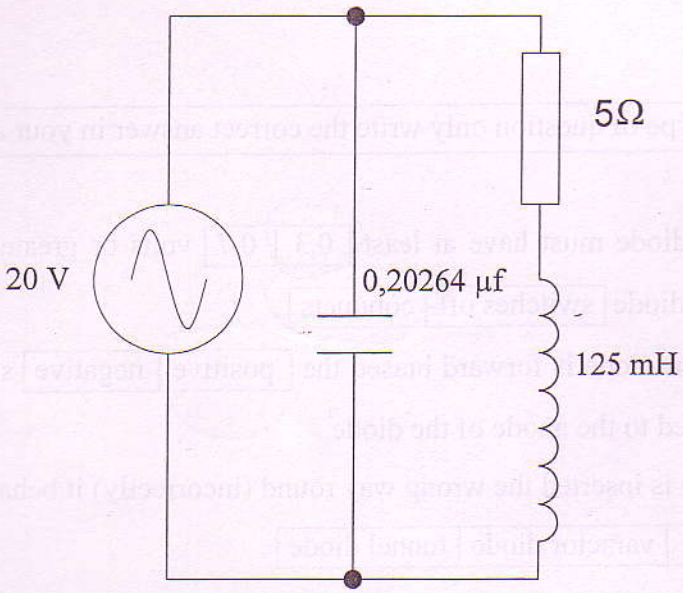


[10]

QUESTION 7

If the following circuit is resonant, calculate the following:-

1) The resonant frequency.
2) The current through the coil.
3) The current through the capacitor.
4) The dynamic impedance.
5) The total current from the supply.
6) Draw the phasor diagram.

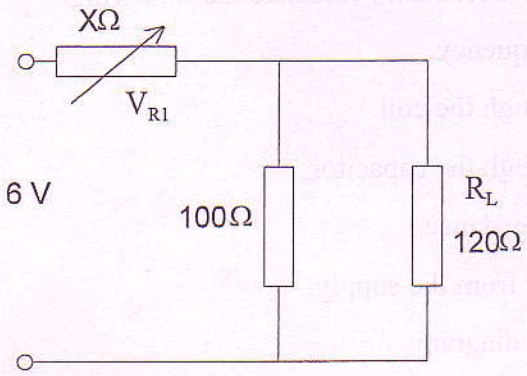


[10]

QUESTION 8

(a) From the following circuit diagram what power is dissipated in R_L when VR_1 is set to 0 Ω? {1}

(b) From the circuit diagram what power is dissipated in R_L when VR_1 is set to 50 Ω? {1}



(For the following type of question only write the correct answer in your assignment)

(c) A germanium diode must have at least | 0,3 | / 0,7 | volts or greater forward bias before the diode | switches off | conducts |. {1}

(d) When a junction diode is forward biased the | positive | negative | side of the supply is coupled to the anode of the diode. {1}

(e) If a zener diode is inserted the wrong way round (incorrectly) it behaves like a | junction diode | varactor diode | tunnel diode |. {1}

(f) What is the expected output voltage of a zener diode, specified as 9 V ± 10%? {1}

(g) In a series RLC circuit at resonance the impedance is at | minimum | maximum | and is equal to | R | X_L | X_C |. {2}

(h) In a series RLC circuit at resonance the supply voltage is equal to | V_R | V_L | V_C | and the circuit current is at a | minimum | maximum |. {2}

[10]

QUESTION 9

(a) Define impedance. {2}

(b) Define or describe Q factor. {2}

(c) In a parallel resonant circuit at resonance the impedance is [minimum | maximum] and the circuit current is at [minimum | maximum]. {2}

(d) At resonance $X_L = X_C$ in [a series | a parallel | both series and parallel] circuit/s. {1}

(e) A series resonant circuit is also known as an [acceptor | rejector]. {1}

(f) A parallel resonant circuit is also known as an [acceptor | rejector]. {1}

(g) At resonance the power factor of a circuit is [1 | 0°]. {1}

[10]

QUESTION 10

Explain with the aid of a neat, labelled circuit diagram, how a unijunction transistor can be used to trigger a silicon controlled rectifier (SCR).

[10]

TOTAL [100]

ASSIGNMENT 2

INDUSTRIAL ELECTRONICS N4

QUESTION 1

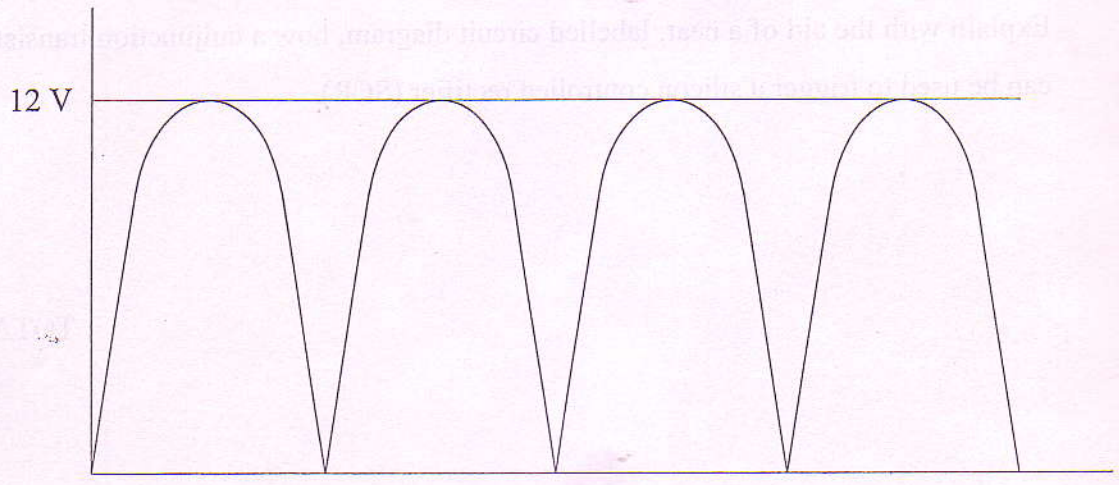
(a) A 9 volt regulator uses a 0,5 W zener diode to supply a constant voltage of 9 volts from a 12 volt supply. Calculate a suitable value for the series resistor if the load current is 15 mA. {4}

(b) A power supply delivers a no-load voltage of 22 volts. At full load the voltage drops to 18 volts. Calculate the percentage voltage regulation. {2}

[6]

QUESTION 2

The following diagram is of the waveform obtained from a full wave bridge rectifier.



Calculate:-

(1) The average DC voltage. {2}

(2) The pulsating DC voltage when no filter circuit is used. {1}

(3) The transformer's secondary RMS voltage. {1}

(4) The output ripple voltage. {2}

(5) The ripple factor when no filter is used. {1}

(6) The transformer's secondary peak voltage. {1}

(7) The transformer's average DC voltage. {1}

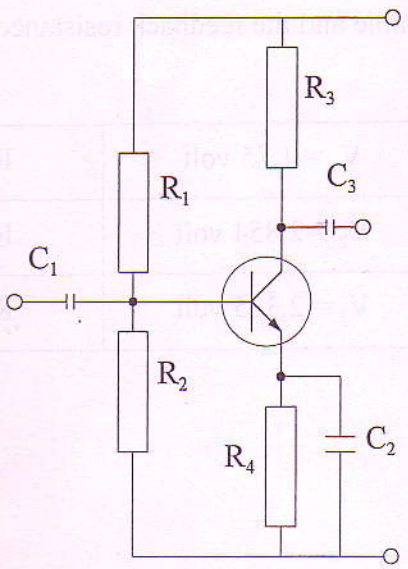
(8) The peak inverse voltage (PIV). {1}

[10]

QUESTION 3

(a) In a CE transistor circuit if the emitter current is 40 mA and the base current is 75 μA, what is the collector current? {2}

(b) What is the function of each numbered component in the following diagram? {3}



What is the affect on the amplifier if C2 is removed? Gain will

increase | decrease. {1}

(c) Draw a neat, fully labelled characteristic curve of a unijunction transistor. {3}

(d) A FET is a current / voltage controlled device. {1}

(e) Draw a neat, fully labelled characteristic curve of a tunnel diode. {4}

[14]

QUESTION 4

(a) Draw a neat, fully labelled circuit diagram to show how a triac can be used to control the speed of a small AC motor. The following voltage waveforms must be shown:- i) Input voltage. ii) Voltage across the motor. iii) Voltage across the triac. {6}

(b) Draw the circuit diagram and calculate the output voltage of a voltage summing op-amp. The values of the input voltages and resistances are given in the table and the feedback resistance is 680 kΩ.

$V_1 = 1{,}75$ volt	$R_1 = 100$ kΩ
$V_2 = 2{,}854$ volt	$R_2 = 120$ kΩ
$V_3 = 2{,}325$ volt	$R_3 = 500$ kΩ

{4}

[10]

QUESTION 5

(a) Define a transducer. {2}

(b) What is the basic function of a potentiometer as a transducer? {2}

(c) Give four requirements of a transducer. {4}

(d) Give two physical quantities that are converted to electrical output values by transducers. {2}

[10]

QUESTION 6

(a) What is a function generator? {2}

(b) Can a function generator supply different output waveforms simultaneously? Motivate your answer. {2}

(c) Draw a block diagram of a basic function generator; your drawing must be fully labelled. {4}

(d) Draw a neat square wave with a mark to space ratio of one. Clearly label the mark, space, a leading edge and a trailing edge. {2}

[10]

QUESTION 7 (Miscellaneous questions)

(a) A sine wave is displayed on a CRO screen (oscilloscope). The peak-to-peak distance is 5 cm and the distance between cycles is 4 cm. The volts/cm dial is set to 10v/cm and the time/div is set at 100 µsec/cm. From the following list of possible answers, choose the correct answer for each of the questions.

25 volt	5 volt	0,4 ms	35,4 volt	4 ms
50 volt	250 Hz	2,5 volt	2,5 kHz	17,7 volt

(i) Determine the peak-to-peak voltage.

(ii) Determine the periodic time of the waveform.

(iii) Determine the maximum value of the voltage.

(iv) Determine the frequency of the waveform.