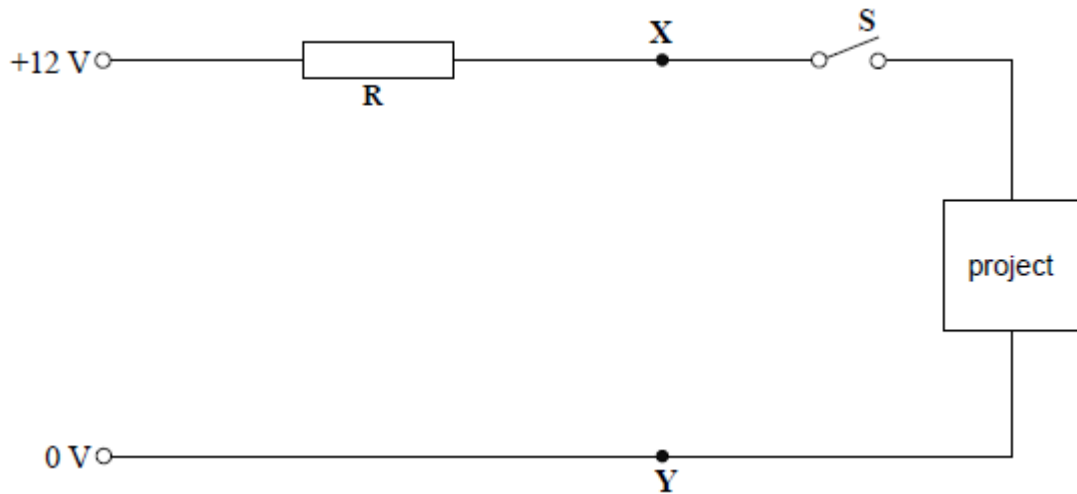


Practice Electronics Topic Exam – time 50 minutes

**Q1.** A Zener diode is used to produce a stabilized 5.1 V from an unregulated 12 V supply to power a project that requires 80 mA.  
Part of the circuit is shown in the diagram.



(a) Draw on the diagram the Zener diode connected correctly between points **X** and **Y**. (2)

(b) The Zener diode requires at least 5 mA to maintain its Zener voltage of 5.1 V.

(i) Calculate the minimum current flowing through **R** when switch **S** is closed. (1)  
 .....

(ii) Calculate the voltage across resistor **R** under these conditions. (1)  
 .....  
 .....

(iii) Calculate the value of resistor **R**. (2)  
 .....  
 .....  
 .....

(c) The circuit in the diagram above is now constructed using a value of 75 Ω for resistor **R**.

(i) Show that the power dissipated in the resistor is approximately 0.6 W. (2)  
 .....  
 .....  
 .....

- (ii) The project is disconnected by turning switch **S** off, but the 12 V supply remains connected.

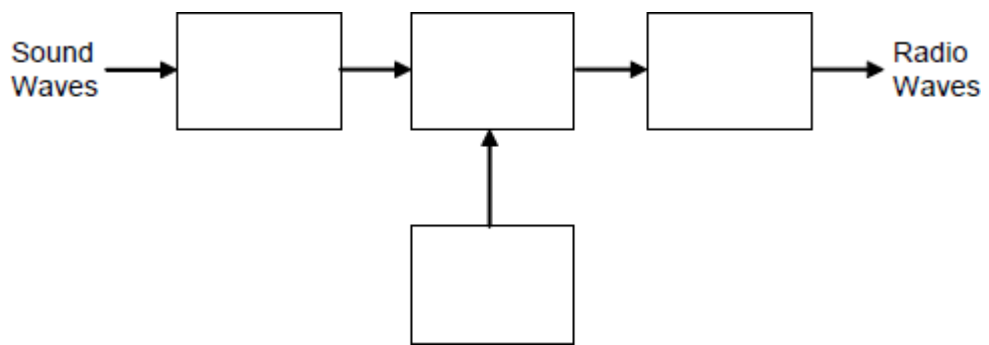
Calculate the current that now flows through the Zener diode.

.....  
 .....  
 .....

(2)  
 (Total 10 marks)

**Q2.(a)** A radio transmitter system consists of the four subsystems.

Label the diagram below with the names of each subsystem.



(4)

- (b) (i) Which **one** of the subsystems above produces an unmodulated rf signal and may contain a tuned circuit?

.....

(1)

- (ii) The tuned circuit contains a 5 pF capacitor and a 0.1 μH inductor. Calculate the frequency of the signal that the subsystem produces.

.....  
 .....  
 .....

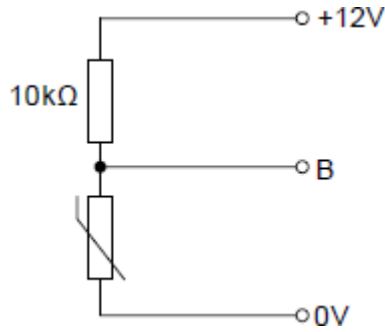
(3)

- (c) A DAB transmitter has a frequency of 227.36 MHz. Calculate the length of a half-wave dipole that would be suitable for use as an aerial for this transmitter.

.....  
 .....  
 .....

(2)  
 (Total 10 marks)

**Q3.A** temperature sensor input subsystem is shown below.

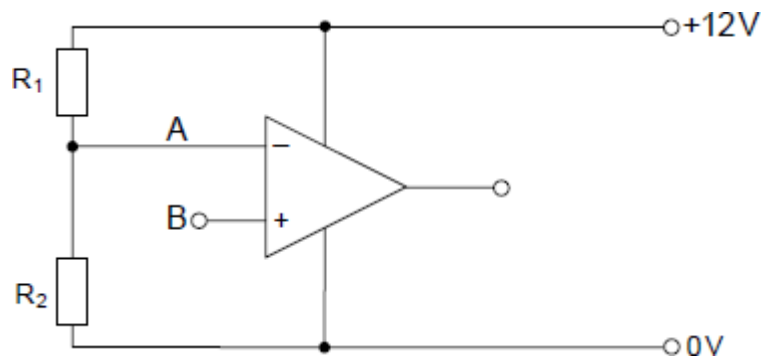


- (a) The thermistor shown above has a resistance of 45 kΩ at 0 °C, 20 kΩ at 25 °C, and 1 kΩ at 100 °C.  
Calculate the output voltage at B at a temperature of 25 °C.

.....  
 .....

(3)

- (b) The temperature sensor input subsystem is connected to the comparator circuit as shown below.



Calculate and choose values of resistors, in the 1 kΩ to 10 kΩ range, for the circuit that will make the comparator switch at 25 °C. Label these on the diagram.

.....  
 .....

(3)

- (c) What voltage would you expect from the output of this circuit when:

(i) the temperature is 20 °C .....

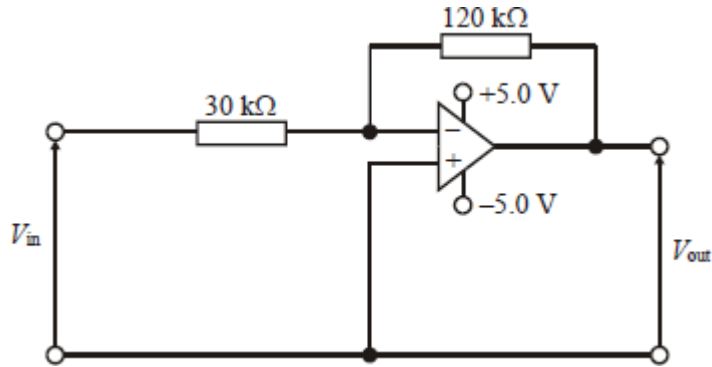
(1)

(ii) the temperature rises to 30 °C? .....

(1)

**(Total 8 marks)**

**Q4.**The diagram below shows an op-amp used in an amplifier circuit.



(a) Name the type of amplifier circuit shown. .... (1)

(b) Calculate the output voltage  $V_{out}$  when the input voltage  $V_{in} = 0.50$  V.  
 .....  
 ..... (2)

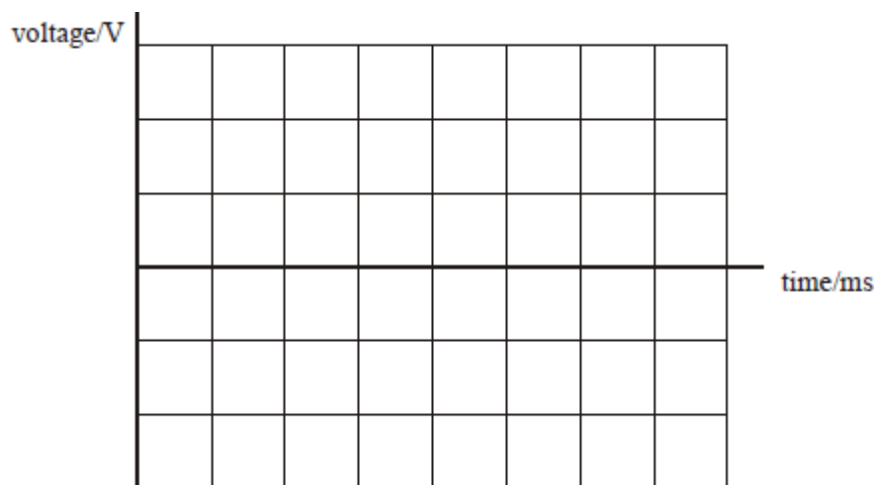
(c) The input is now connected to a sinusoidal source of rms output 2.0 V and frequency 50 Hz.

(i) Calculate the peak input voltage.  
 .....  
 .....

(ii) On the axes below draw a trace showing **two** cycles of the input signal and label it **A**.

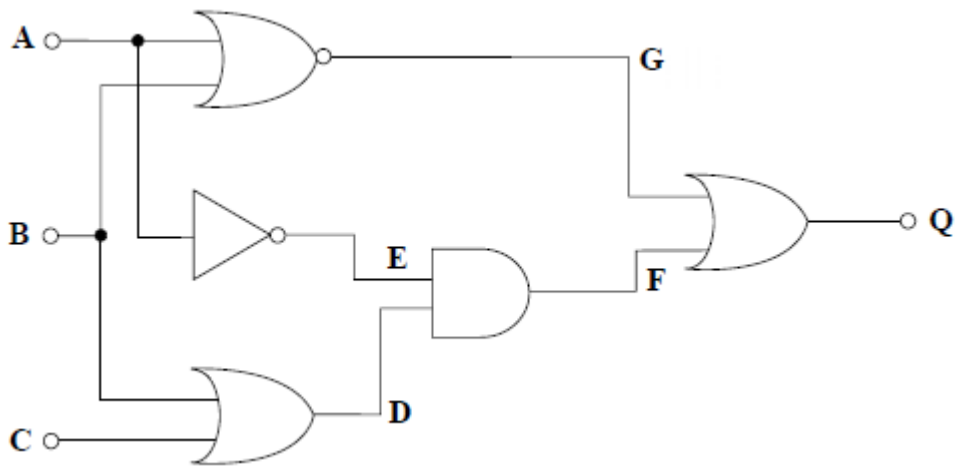
On the same axes, draw the **two** corresponding cycles of the output signal and label it **B**.

Add suitable scales to the axes.



(6)  
 (Total 9 marks)

**Q5.**The diagram shows a logic circuit with three inputs **A**, **B** and **C**.



- (a) Write the Boolean expressions for the signals at the intermediate points **D**, **E**, and **G** in terms of the inputs **A**, **B** and **C** only.

**D** .....

**E** .....

**G** .....

(3)

- (b) Complete the truth table below for the logic signals at the intermediate points **D**, **E** and **G**.

Inputs			Intermediate points		
<b>C</b>	<b>B</b>	<b>A</b>	<b>D</b>	<b>E</b>	<b>G</b>
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

(5)  
(Total 8 marks)