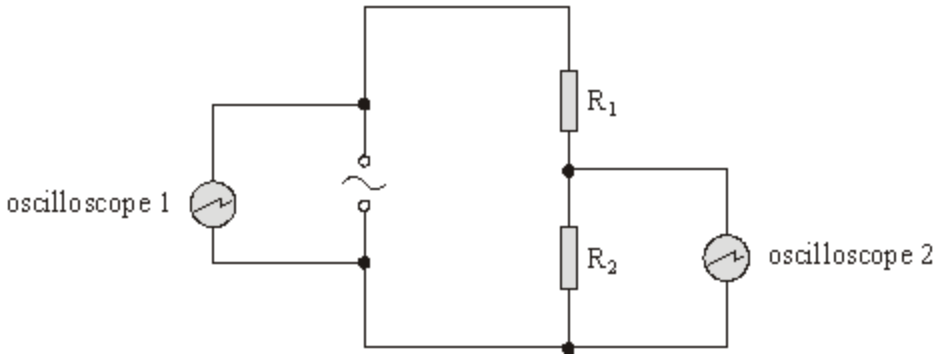
Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Q1.

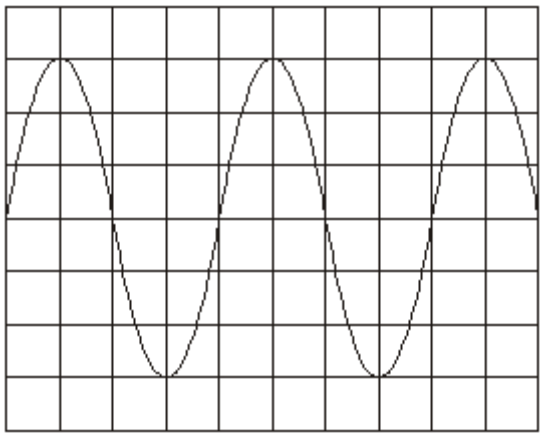
The circuit in **Figure 1** shows a sinusoidal ac source connected to two resistors, R_1 and R_2, which form a potential divider. Oscilloscope 1 is connected across the source and oscilloscope 2 is connected across R_2.

Figure 1



(a) **Figure 2** shows the trace obtained on the screen of oscilloscope 1. The time base of the oscilloscope is set at 10 m/s per division and the voltage sensitivity at 15 V per division.

Figure 2



For the ac source, calculate

(i) the frequency,

_____

_____

(ii) the rms voltage.

_____

_____

_____

(4)

(b) The resistors have the following values: $R_1 = 450\ \Omega$ and $R_2 = 90\ \Omega$.
Calculate

(i) the rms current in the circuit,

_____

(ii) the rms voltage across R_2.

_____

(2)

(c) Oscilloscope 2 is used to check the calculated value of the voltage across R_2. The screen of oscilloscope 2 is identical to that of oscilloscope 1 and both are set to the same time base. Oscilloscope 2 has the following range for voltage sensitivity: 1 V per div., 5 V per div., 10 V per div. and 15 V per div.
State which voltage sensitivity would give the most suitable trace. Explain the reasons for your choice.

_____

_____

_____

_____

_____

(3)
(Total 9 marks)

Q2.

The last refracting telescope that could be called 'the largest optical telescope in the world' was one with an objective lens of diameter 0.90 m. It was superseded in 1889 by a reflecting telescope with an objective mirror of diameter 1.52 m.

(a) Calculate

(i) the ratio $\frac{\text{resolving power of the reflector}}{\text{resolving power of the refractor}}$.

_____

_____

_____

_____

(ii) the ratio $\frac{\text{the amount of light energy that can be collected per second by the reflector}}{\text{the amount of light energy that can be collected per second by the refractor}}$.

_____

_____

_____

_____

(3)

(b) Spherical aberration can be a problem with reflecting telescopes.

(i) Draw a ray diagram to show how spherical aberration arises in a reflecting telescope.

(ii) State how this problem can be prevented.

_____

(2)

(c) The image produced by a refracting telescope can be clearer than that of a similar diameter reflector because of the position of the secondary mirror.

(i) Sketch a diagram to show the position of the mirrors in a Cassegrain telescope.

(ii) Give **two** reasons why the secondary mirror in the Cassegrain telescope affects the clarity of the image.

_____

_____

_____

_____

(3)

(Total 8 marks)