5 **(a)** State Faraday's law of electromagnetic induction.

....

....

.... [1]

(b) Fig 5.1 shows a system used by an engineer to determine the constant rate of revolution of a rotating cylinder.

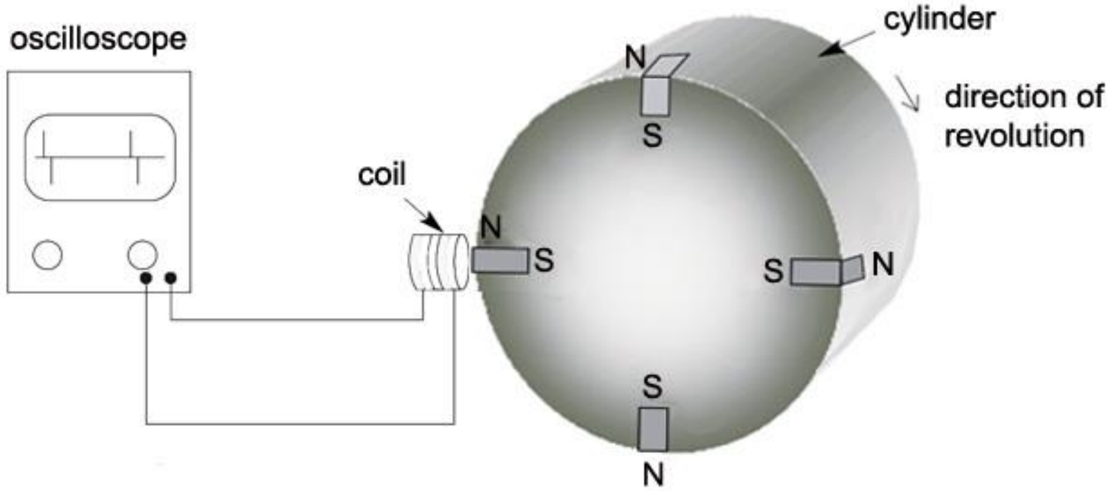

Fig. 5.1

Four small bar magnets are embedded in the cylinder as shown. The North-pole of each magnet is on the exterior of the cylinder. As the cylinder rotates, a voltage is produced between the terminals of a coil placed close to the cylinder.

The voltage produced is monitored using a cathode ray oscilloscope (c.r.o.). The waveform displayed on the c.r.o. is shown in Fig 5.2.

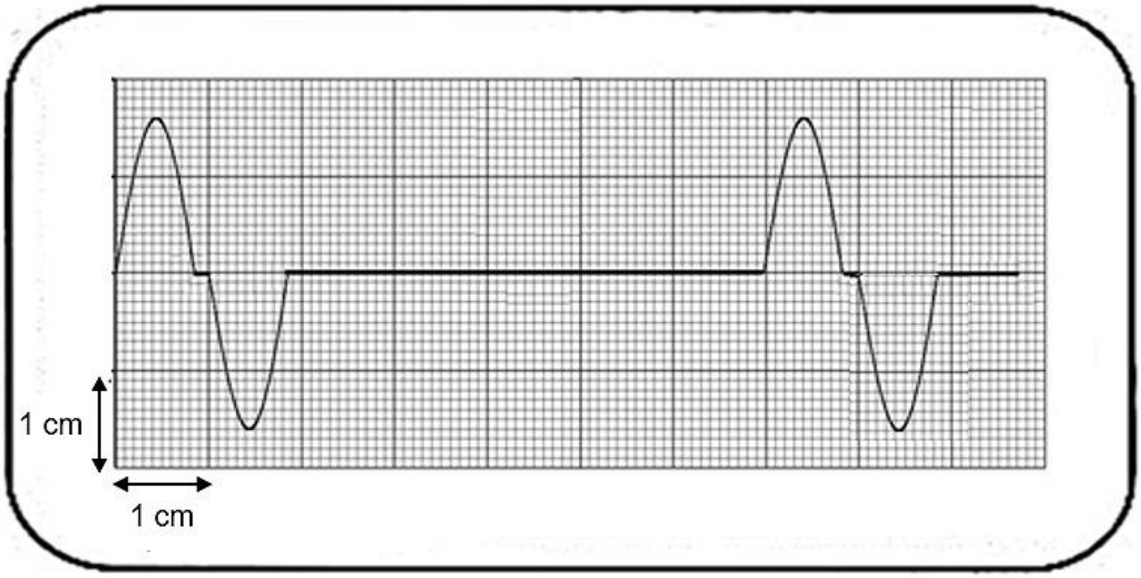

Fig. 5.2 (not to scale)

Given:

Y-plate sensitivity = 5.0 mV cm^{-1}

Time-base setting = 10 ms cm^{-1}

(i) Using the laws of electromagnetic induction, explain the shape of the waveform obtained in Fig. 5.2.

....

....

....

....

.... [2]

(ii) Determine the number of revolutions made by the cylinder in one minute.

number of revolutions = ... [3]

(iii) Determine the maximum rate of change of magnetic flux linkage of the coil.

maximum rate of change of flux linkage = ... Wb s^{-1} [1]

(iv) Describe and explain the changes, if any, to the waveform displayed in Fig. 5.2 when the rate of revolution of the cylinder is doubled.

....

....

....

....

....

....

.... [3]

[Total: 10]