7 **(a)** State the *laws of electromagnetic induction*.

……

……

…… [2]

(b) The diameter of the cross-section of a long solenoid with 15 turns is 3.2 cm, as shown in Fig. 7.1.

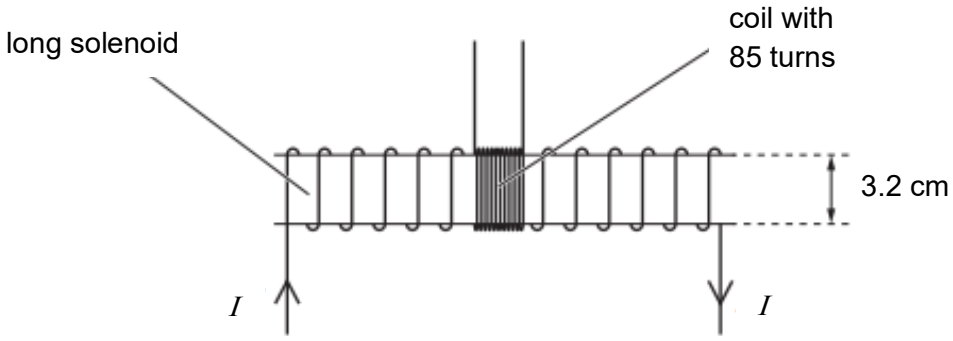

Fig. 7.1

A coil with 85 turns of wire, is wound tightly around the centre region of the solenoid. The magnetic flux density *B*, in tesla, at the centre of the solenoid is given by the expression

$$B = \pi \times 10^{-3} \times I$$

where I is the current in the solenoid in ampere.

(i) Calculate, for a current I of 2.8 A in the solenoid, the magnetic flux linkage of the coil.

magnetic flux linkage = …… Wb [2]

(ii) The current I in the solenoid in **(b)(i)** is reversed in 0.30 s.

Calculate the mean e.m.f. induced in the coil.

e.m.f. induced = …… mV [2]

(iii) The current *I* in the solenoid in **(b)(i)** is now varied with time *t* as shown in Fig. 7.2.

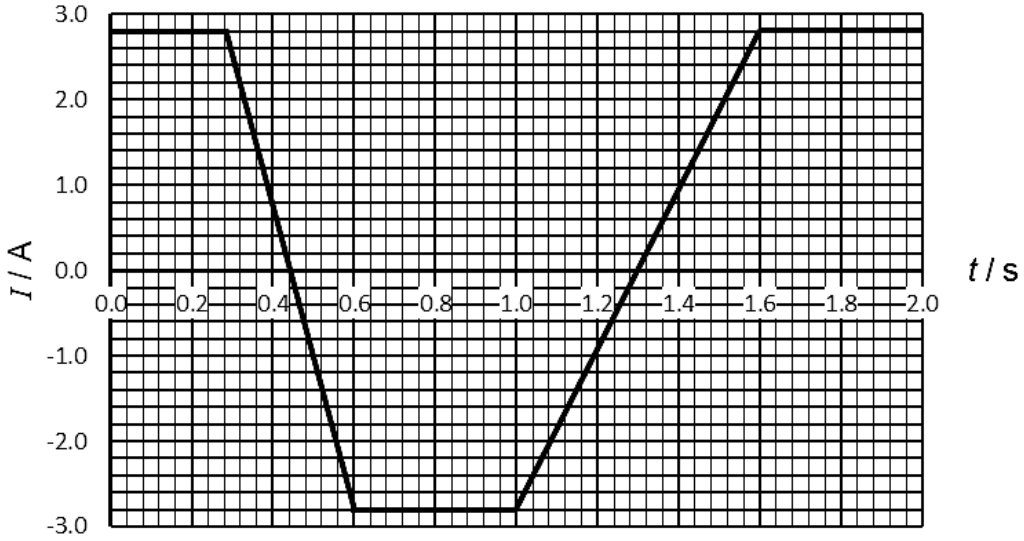

Fig. 7.2

Use your answer to **(b)(ii)** to show, on Fig. 7.3, the variation with time *t* of the e.m.f. *E* induced in the coil.

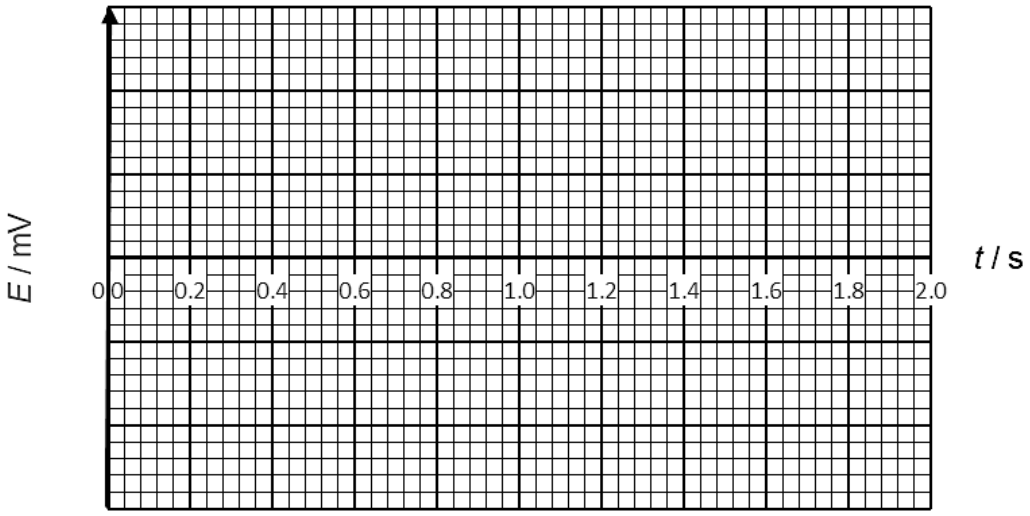

Fig. 7.3

[3]