6 **(a)** A helicopter has four main rotor blades, each of length 8.0 m, as shown in Fig. 6.1 and Fig. 6.2

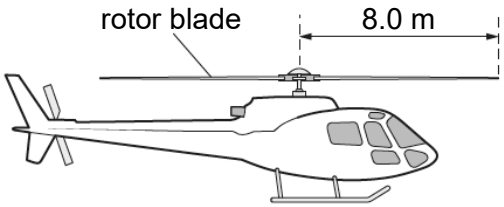

Fig. 6.1
(view from the side)

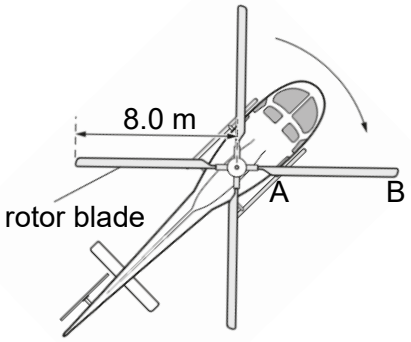

Fig. 6.2
(view from the top)

The rotor blades are horizontal and rotating at 200 revolutions per second. This causes the helicopter to remain stationary in equilibrium in the air. Viewed from above, the direction of rotation is clockwise.

The Earth's magnetic field through the rotor blades is uniform. It has a magnitude of 4.7×10^{-5} T and is in a direction downwards at an angle of 50° to the horizontal, as shown in Fig. 6.3.

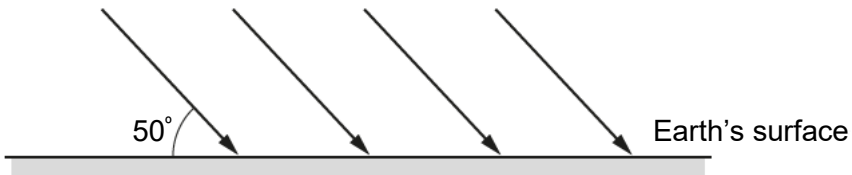

Fig. 6.3

(i) Calculate the e.m.f. induced across the two ends of a rotor blade.

e.m.f. = ……..... V [3]

(ii) With reference to Fig. 6.2 and by considering the motion of electrons in the rotor blade, state and explain which end of the rotor blade (the inner end A or the outer end B) is at the higher potential.

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..... [3]

(b) A circuit contains a power supply that provides a sinusoidal alternating input voltage V_{IN}. There is an output voltage V_{OUT} across a load resistor R, as shown in Fig. 6.4.

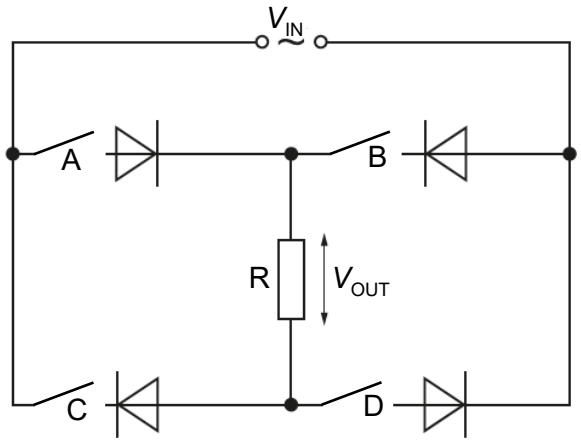

Fig. 6.4

Fig. 6.5 shows the variation of V_{OUT} with time t when all switches A, B, C and D are closed.

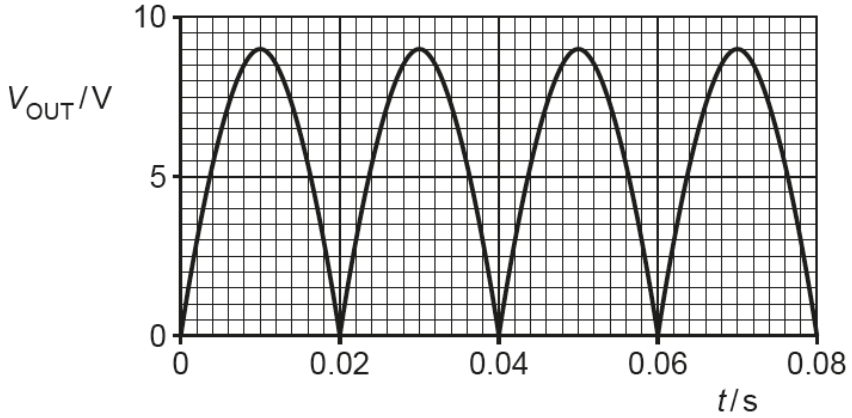

Fig. 6.5

(i) The load resistor R has a resistance of 370 Ω.

Calculate the mean power dissipated in R.

mean power = ……..... W [2]

(ii) Switches B and C are then opened. Switches A and D remain closed.

Explain, without calculation, how the mean power now dissipated in R compares with the answer in **(b)(i)**.

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..... [2]