Q- A block-spring system oscillates with amplitude of 3.50 cm. The spring constant is 250 N/m and the mass of the block is 0.600 kg.
(a) Determine the mechanical energy of the system.

(b) Determine the maximum speed of the block.

(c) Determine the maximum acceleration.

(a) When the block is at an extreme position, whole energy of the system is stored in form of elastic potential energy and as the elongation in the spring at that time is equal to the amplitude of the oscillation, the total energy of the system is given by

$$U = \frac{1}{2}kA^2 = \frac{1}{2} * 250 * (0.035)^2 = 0.153\ J$$

(b) When the block will come to the mean position extension in the spring will be zero and the whole elastic potential energy will convert to kinetic energy of the block and the speed of the block is maximum. If the maximum speed of the block is v_{max} than

$$\frac{1}{2}\ mv_{max}^2 = U$$

Or $\quad \frac{1}{2} * 0.600\ v_{max}^2 = 0.153$

Or $\quad v_{max}^2 = 0.510$

Gives $\ v_{max} = 0.714\ m/s$

(c) The maximum force on the block is at extreme position when the extension in the spring is maximum thus

$$a_{max} = \frac{F_{max}}{m} = \frac{kA}{m} = \frac{250*0.035}{0.600} = 14.6\ m/s^2$$