This assignment covers *Units 8, 9, 12* and *14*.

Unit 8

Questions 1 to 5

The displacement from equilibrium, in metres, of a particle of mass $\frac{1}{2}$ kg performing damped harmonic oscillations is given by

$$x(t) = 2\exp(-5t)\cos\left(12t - \tfrac{1}{6}\pi\right).$$

All quantities are measured in the appropriate SI units.

1 Select the option which is the damping constant, r, of the system.

2 Select the option which is the damping ratio, α, of the system.

3 Select the option which is the undamped angular frequency, ω_0, of the system.

4 Select the option which is the angular frequency, Ω, of the damped vibrations of the system.

Options for Questions 1 to 4

A	5	**B**	12	**C**	13	**D**	$\frac{5}{12}$
E	$\frac{5}{13}$	**F**	$\frac{12}{5}$	**G**	$\frac{12}{13}$	**H**	$\frac{13}{12}$

5 Select the option which is closest to the factor $x(t+\tau)/x(t)$ by which the amplitude of the oscillations decreases in each period τ.

Options

A	0.02	**B**	0.07	**C**	0.17	**D**	0.24
E	0.73	**F**	0.76	**G**	0.93	**H**	0.98

Question 6

The displacement of a mechanical system satisfies the differential equation

$$m\ddot{x} + r\dot{x} + kx = 0.$$

If $m = 2$ and $k = 8$, what is the value of the damping constant r in order that the damping of the system should be critical?

Options

A	1	**B**	2	**C**	4	**D**	8
E	16	**F**	32	**G**	64		