



RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES, MIHINTALE

B.Sc. (General) Degree in Applied Sciences
First Year Semester I Examination – June / July 2018

PHY 1102 – WAVES AND VIBRATIONS

Time: One (01) hour

Answer two questions only.

1. a)

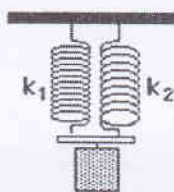


Figure A

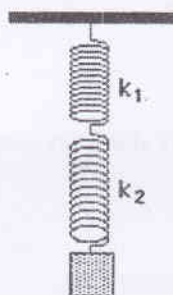


Figure B

What are the effective spring constants (K_{eff}) of the systems given in the **Figure A** (two springs in parallel) and in the **Figure B** (two springs in series)? K_1 and K_2 are the spring constants of springs as shown. What are the assumptions you made? (10 marks)

- b) What are Lissajous figures? Give an example. (10 marks)
- c) Two Simple Harmonic Motions (SHMs) at right angles to one another are described by the following equations.

$$y = 10 \sin(\omega t) \quad \text{and}$$

$$x = 10 \sin(\omega t - \pi/2)$$

Construct the Lissajous figure of the above combined motion. (30 marks)

2. a) What is Doppler effect? (05 marks)

c) A sound (ultrasound) wave is sent along a blood vessel, and the moving blood cells reflect it. The blood cells effectively become a source of sound waves which moves at the speed of the blood.

The speed of sound in blood is 1.545 ms^{-1} .

The blood cells reflect sound waves at a frequency of $1.0522 \times 10^6 \text{ Hz}$. Since the cells are moving, the wavelength of sound is Doppler shifted. The reflected sound is detected with a wavelength of $1.4670 \times 10^{-3} \text{ m}$.

Calculate the speed of the blood cells. (30 marks)

b) Explain the concept of "Redshift in light" used by the astronomers. (15 marks)

3. Write **short notes** on the following;

(i) Periodic motion in Physics. (12 marks)

(ii) Examples for critically damped systems. (13 marks)

(iii) Binary stars. (12 marks)

(iv) Principle of superposition. (13 marks)

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