



CINEC CAMPUS(PVT)LTD
 Faculty of Marine Engineering
 Department of Marine Engineering
 EDUCATION & TRAINING COURSE: NAVIGATION/ ENGINEERING OFFICER CADET FOUNDATION TRAINING COURSE
 COURSE CODE: ED 0340

 1ST SEMESTER EXAMINATION QUESTION PAPER
 Physics

- Answer Any 06 Questions

Date: 2024.02.29

Pass mark 50%

Time allocated: 03 Hrs

➤ Some helpful Data:

* Speed of sound in air 340 m/s

1.
 - a. Describe the Simple Harmonic Motion (3 marks)
 - b. A certain mass hangs from a light spring of the force constant $k = 400 \text{ N/m}$. The mass is pulled down 10 mm from its equilibrium position and then released from rest.
 - i. Find the amplitude, frequency, and period of the motion. (6 marks)
 - ii. Write down the general expression for displacement, speed and acceleration of the motion. (3 marks)
 - iii. Find the velocity and acceleration of mass 7 mm below the equilibrium (4 marks)
 - iv. Find the kinetic energy and potential energy when the block is 7 mm below the equilibrium (4 marks)
2.
 - a. Write down an expression for the speed of sound in solids (4 marks)
 - b. Find the speed of sound in iron core. Hint: density of iron and modulus of elasticity are 7.86 g/cm^3 and 170 GPa . (4 marks)
 - c. Write down an expression for the speed of sound in air (4 marks)
 - d. Find the speed of sound in air if the pressure and density of the atmosphere at 30°C are 101.3 kPa and 1.225 kg/m^3 respectively. Hint $\gamma = 1.4$ for air (4 marks)
 - e. The speed of sound in air at 30°C is 340 m/s . Find the speed of the sound in air at 0°C (4 marks)

- 3.
- Write an expression for the speed of a wave appear in stretched wire (4 marks)
 - Write down expressions for the fundamental frequency, first and second overtones of an oscillating string. (6 marks)
 - A wire of **60 cm** length and **120 g** is stretched under **150 N** of tension. Find the speed of wave in the wire, the fundamental frequency, first and second overtones. (10 marks)

- 4.
- Write expressions for the frequencies of fundamental and of the first two overtones produced in an closed organ pipe (4 marks)
 - An organ pipe **1.25 ft** long is closed at one end. If the velocity of sound is **1100 ft/s**, what are the frequencies of the fundamental and of the first two overtones? (8 marks)
 - Two closed orgen pipes, one **1.5 ft** and **1.48 ft** in length, are sounded simultaneously. How many beats per second will be produced between the fundamental tones if the velocity of sound is **1100 ft/s**? (8 marks)

- 5.
- Sketch graphs for the variation of kinetic energy, potential energy and total energy with displacement in a simple harmonic motion (6 marks)
 - A spring is stretched **4 cm** when a mass of **40 g** is hung on it. If a total of **120 g** is hung on the spring and the mass is started in a vertical oscillation, what will the period of the oscillation? (6 marks)
 - Write an expression for the periodic time of simple harmonic motion of a simple pendulum (4 marks)
 - Find the period of oscillation of a simple pendulum which has **0.5 kg** of mass and string with **1.2 m** length. (4 marks)

6. A sound-progressive wave in air is represented by the equation

$$P(x, t) = 8.2 \text{ Sin}(1024\pi t - 1.5058\pi x)$$

Where P is the pressure in Pascals, t is in seconds and x is the distance from a fixed origin O in metres (m). Determine

- The amplitude (4 marks)
- The frequency of the wave (4 marks)
- Its wave length (4 marks)
- Its speed (4 marks)
- The audible pressure of the wave when $x = 1.5 \text{ m}$ and $t = 5 \text{ s}$. (4 marks)

7. A standing wave appear on a string is given by

$$y(x, t) = 0.02 \cos(12.5\pi x) \sin(220\pi t)$$

Where y is the displacement in millimeters, t in seconds and x is in meters. Determine

- Amplitude of the string (2 marks)
- The frequency of the standing wave (4 marks)
- The wave length (4 marks)
- The speed of the wave (4 marks)
- The tension of the string if the density 0.524 g/cm (6 marks)

8.

- Write down the beat formula for two tuning-forks of slightly different frequencies of f_1 and f_2 are sounded together. (2 marks)
- A tuning fork of frequency 256 Hz is sounded with a fork of unknown frequency $f \text{ Hz}$, 45 beats per minute are heard. When a little plasticine is added to the prongs of the unknown fork, the beats decrease in number. Find the value of f . (4 marks)
- At a distance 15 m from a small loudspeaker of 100 W , the amplitude of the sound heard is 0.018 mm .
 - Find the amplitude at a distance 30 m from the loudspeaker (4 marks)
 - Find the sound intensity at each distances (4 marks)
 - Find the loudness change (dB) when the distance changes from 15 m to 30 m . Hint: threshold of hearing is 10^{-12} W/m^2 . (6 marks)

9.

- An underwater sonar source operating at a frequency of 60 kHz directs its beam toward the surface. What is the wavelength of the beam in the air above? What frequency sound due to the sonar source does a bird flying above the water hear? Assume that the speed of sound in air is 340 m/s . (4 marks)
- Define the Doppler effect (4 marks)
- The source of sound s is moving with a velocity 10 m/s towards a stationary observer. The observer measures the frequency of the source as 1024 Hz . The velocity of sound in the medium is 340 m/s .
 - What is the actual frequency of the source (6 marks)
 - What will be the apparent frequency of the source when it is moving away from the observer after crossing him? (6 marks)



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1ST SEMESTER EXAMINATION QUESTION PAPER
Mathematics

- Answer Any 06 Questions

Date: 2028.02.28

Pass mark 50%

Time allocated: 03 Hrs

Question 1

(100 marks)

Factorize the given expressions.

- | | | |
|------|------------------|------------|
| i. | $6x^2 - 5x - 6$ | (25 marks) |
| ii. | $2x^2 - 11x + 5$ | (25 marks) |
| iii. | $4x^2 - 49$ | (25 marks) |
| iv. | $x^2 + 6x + 8$ | (25 marks) |

Question 2

(100 marks)

- | | | |
|-----|-----------------------------|------------|
| i. | Solve : $3x^2 - 5x + 2 = 0$ | (50 marks) |
| ii. | Solve : $3x^2 + 5x = 12$ | (50 marks) |

Question 3

(100 marks)

Standard equations of the arithmetic progression :

$$T_n = a +$$

$$(n - 1)d \quad S_n = \frac{n\{2a+(n-1)d\}}{2}$$

- | | | |
|-----|---|------------|
| i. | How many terms are there in the sequence 120, 114, 108,....., 36 ? | (50 marks) |
| ii. | Find the sum of the first 100 terms $1, 1\frac{1}{4}, 1\frac{1}{2}, 1\frac{3}{4}, \dots$ | (50 marks) |

Question 4**(100 marks)**

Standard equations of the geometric progression $T_n = ar^{n-1}$, $S_n = \frac{a(r^n-1)}{(r-1)}$

- i. Find the 7th term in the geometric sequence 8, 24, 72, 216, (25 marks)
- ii. The first 3 terms of an infinite geometric progression are 16, 12 and 9
- (a) Write down the common ratio. (25 marks)
- (b) Find the sum of the terms of the progression. (50 marks)

Question 5**(100 marks)**

- i. Solve: $x + 2y = 7$ and $x^2 + y^2 = 10$ (50 marks)
- ii. Solve: $x^2 - 2y^2 = 8$ and $x + 2y = 8$ (50 marks)

Question 6**(100 marks)**

- i. Prove the identity $\sec^2 x - \operatorname{cosec}^2 x = \tan^2 x - \cot^2 x$ (50 marks)
- ii. Prove the identity $\frac{1 - \tan x}{1 + \tan x} = \frac{\cot x - 1}{\cot x + 1}$ (50 marks)

Question 7**(100 marks)**

- i. Simplify
- a) $\log_2 128$ (25 marks)
- b) $\log_3(27 \times 243)$ (25 marks)
- ii. Evaluate $\log_2 x + \log_x 2 = 2$ (50 marks)

Question 8**(100 marks)**

- i. Evaluate $27^{\frac{2}{3}}$ (25 marks)
- ii. Evaluate $\sqrt{36 * 49}$ (25 marks)
- iii. Evaluate $\left(\frac{125}{64}\right)^{\frac{2}{3}}$ (50 marks)