

C 42961

(Pages : 3)

Name.....

Reg. No.....

SECOND SEMESTER (CUCBCSS-UG) DEGREE EXAMINATION, APRIL 2023

Physics/Applied Physics

PHY 2B 02/APY 2B 02—PROPERTIES OF MATTER WAVES AND ACOUSTICS

(2017–2018 Admissions)

Time : Three Hours

Maximum : 80 Marks

Section A

*Answer all questions.
1 mark each.*

1. Relation between Y, η and σ is _____.
2. A horizontal beam fixed at one end and loaded at the other end is called _____.
3. The number of vibrations in one second is called _____.
4. What is a damped harmonic oscillator ?
5. What is meant by resonant frequency of a forced harmonic oscillator ?
6. In transverse wave motion, Particles of the _____ vibrate _____ the direction of wave propagation.
7. What is the unit of energy density ?
8. What are antinodes ?
9. Write the relation between velocity of sound and absolute temperature
10. What is reverberation ?

(10 × 1 = 10 marks)

Section B

*Answer all questions.
Write in two or three sentences.
2 marks each*

11. Define Bulk modulus of elasticity with equation.
12. What is angle of twist ?
13. What do you mean by intensity of a wave ?
14. How 'T' section girders work ?

Turn over

15. Define Fourier's theorem.
16. Define Q factor.
17. Differentiate between wave velocity and group velocity.

(7 × 2 = 14 marks)

Section C

*Write any five questions.
Write in one paragraph.
4 marks each.*

18. Obtain the expression for velocity of sound wave.
19. Deduce the expression for couple per unit twist of a uniform solid cylinder.
20. Derive the expression for the depression at the loaded end of a cantilever.
21. Explain the terms : a) amplitude b) period c) frequency of wave motion.
22. Write down difference between reflections at a free boundary and rigid boundary.
23. Explain the modes of vibrations in stretched string.
24. Explain nodes and antinodes.

(5 × 4 = 20 marks)

Section D

*Solve any four problems.
4 marks each.*

25. Calculate the speed of transverse wave in a wire of radius 0.56 mm subjected to a tension of 2kgwt. Given the density of the material of the wire is 8500 kg/m².
26. A particle makes S.H.M. along a straight line and its velocity when passing through points 3 cm and 4 cm from the centre of its path is 16 cm/s and 12 cm/s respectively. Find (a) the amplitude, (b) the time period of motion.
27. A particle of mass 10kg lies in a potential field $V = (50x^2 + 100)$ Joule/kg. Deduce the frequency of oscillation.
28. A light metal rod of length 60 cm and of radius 1 cm is clamped at one end loaded at the free end, with 5.5 kg. Calculate the depression of the free end assuming $Y = 9 \times 10^{10}$ N/m².
29. A circular disc of radius 20cm oscillates as a pendulum about a point on its circumference. Calculate the period of oscillation.

30. Find a Fourier's series for the function defined by the equations

$$Y = 1 \text{ for } t = 0 \text{ to } t = T/2$$

$$0 \text{ for } t = T/3$$

$$+1 \text{ for } t = T/2 \text{ to } t = T$$

31. Prove that the velocity of a particle in S.H.M. at a distance $\sqrt{3}/2$ of its amplitude from the centre is half of its velocity at the central position.

(4 × 4 = 16 marks)

Section E

*Write any two.
10 marks each.*

32. Explain transverse waves in stretched string and derive the equation for velocity
33. Define Poisson's ratio. Derive the relation connecting Y , η and σ .
34. What is damping force? Derive the equation for damped harmonic oscillator. Explain over damped and under damped cases.
35. Study the variation of KE, PE and Total energy of SHM with displacement.

(2 × 10 = 20 marks)

C 21835

(Pages : 3)

Name.....

Reg. No.....

**SECOND SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
APRIL 2022**

Physics/Applied Physics

PHY 2B 02/APY 2B 02—PROPERTIES OF MATTER WAVES AND ACOUSTICS

(2016—2018 Admissions)

Time : Three Hours

Maximum : 80 Marks

Section A*Answer all questions**1 marks each.*

1. S.I. unit of strain is _____.
2. Relation between Y , K and σ is _____.
3. What is the equation of bending moment of a beam ?
4. Time for one complete oscillation is called _____.
5. For a wave of period 10 seconds, frequency = _____ Hz
6. What is damping constant ?
7. In longitudinal wave motion, Particles of the _____ vibrate _____ the direction of wave.
8. Define stationary wave.
9. A given periodic function is capable of Fourier analysis if the function is _____ and _____.
10. Decibel is the unit of _____.

(10 × 1 = 10 marks)

Section B*Answer all questions.**Write in two or three sentences.**2 marks each.*

11. What is a torsion pendulum ?
12. Derive the differential equation of motion for a simple harmonic oscillator.

Turn over

13. Derive the theoretical limiting values of Poisson's ratio.
14. Explain principle of superposition.
15. Show that in a damped harmonic oscillator velocity decreases exponentially with time.
16. What is angle of twist ?
17. What is anharmonic oscillator ?

(7 × 2 = 14 marks)

Section C

*Write any five questions.
Write in one paragraph.
4 marks each.*

18. Write and explain the equation of differential equation of damped harmonic oscillator.
19. Differentiate between wave velocity and group velocity.
20. Obtain the expression for velocity of longitudinal waves in rods.
21. State Fourier theorem. Explain its importance and limitations.
22. Derive the relation between elastic constants and Poisons ratio.
23. Differentiate between reflection at rigid boundary and free boundary.
24. Derive the equation for work done work done in a torsion pendulum

(5 × 4 = 20 marks)

Section D

*Solve any four problems.
4 marks each.*

25. Calculate The Poisson's ratio for steel, given that its Youngs modulus is $2 \times 10^{11} \text{Nm}^{-2}$ and rigidity modulus is $8 \times 10^{10} \text{Nm}^{-2}$.
26. Calculate the work done in twisting a steel wire of diameter 2 mm. and length 0.25 m. through an angle 45° . Given rigidity modulus for steel is $8 \times 10^{10} \text{Nm}^2$.
27. A steel tap is stretched so that its length is 0.001 % of its initial line. If $Y = 200 \text{ GPa}$, Calculate the stress required

28. A plane progressive wave traveling along positive X direction has amplitude 0.2 cm, velocity 360 cm/s and wavelength 60 cm. (a) Write down its equation when (1) the displacement is zero at $x = 0$ and $t = 0$; (2) displacement is maximum at $x = 0$ and $t = 0$. (b) Also find the displacement in either case at $x = 120$ cm and $t = 2$ s.
29. Calculate the tensile stress in a wire of density 8000 kgm^{-3} . When the velocity of transverse wave on it is equal to 340 ms^{-1} .
30. Find a Fourier's series for the function defined by the equations
- Y =
- 1 for $t=0$ to $t = T/2$
- 0 for $t = T/3$
- + 1 for $t = T/2$ to $t = T$
31. Prove that the velocity of a particle in S.H.M. at a distance $\sqrt{3}/2$ of its amplitude from the centre is half of its velocity at the central position.

(4 × 4 = 16 marks)

Section E*Write any two questions.**10 marks each.*

32. Explain the composition of two rectangular simple harmonic motions of equal periods Define forced harmonic oscillator.
33. What is damping force? Derive the equation for damped harmonic oscillator. Explain over damped and under damped cases.
34. Study the variation of KE, PE and Total energy of SHM with displacement.
35. Explain in detail, acoustics of buildings.

(2 × 10 = 20 marks)

C 4170

(Pages : 3)

Name.....

Reg. No.....

**SECOND SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
APRIL 2021**

Physics/Applied Physics

PHY 2B 02/APY 2B 02—PROPERTIES OF MATTER WAVES AND ACOUSTICS

Time : Three Hours

Maximum : 80 Marks

Section A*Answer all questions.**1 mark each.*

1. State Hook's law.
2. The reciprocal of Bulk modulus is _____.
3. The bending moment for a circular cross section is _____.
4. At what value of x , the velocity of a harmonic oscillator becomes maximum ?
5. Define Frequency.
6. Is the total energy E of harmonic oscillator a constant ?
7. State Fourier's theorem.
8. Give an example of damping in physical systems.
9. Define group velocity.
10. What is intensity of sound ?

(10 × 1 = 10 marks)

Section B*Answer all questions.**Write in two or three sentences.**2 marks each.*

11. Give the relation connecting three elastic constants.
12. What are the limiting values of Poisson's ratio ?
13. What is the acceleration of a particle executing SHM ?

Turn over

14. Write the expression for kinetic energy of a harmonic oscillator.
15. What is damping force ?
16. What are longitudinal waves ?
17. What is Reverberation ?

(7 × 2 = 14 marks)

Section C

*Write any **five** questions.
Write in one **paragraph**.
4 marks each.*

18. Explain I form of Girders.
19. Obtain the differential equation for SHM.
20. Describe quality factor and power dissipation.
21. Explain about an anharmonic oscillator.
22. Describe the modes of transverse vibrations in a string.
23. Write a note on energy density of a plane progressive wave.
24. Describe acoustic grating.

(5 × 4 = 20 marks)

Section D

*Solve any **four** problems.
4 marks each.*

25. Determine the force per unit area required to compress a volume of water by one percent. Bulk modulus of water is 2×10^{10} dynes/cm².
26. A harmonic oscillator has a total energy E. Determine the kinetic and potential energies when the displacement is one half the amplitude.
27. If the amplitude of a seconds pendulum with a bob of mass 0.2 kg is reduced to half its undamped value in 200 seconds. What is its quality factor Q ?
28. A particle executing SHM has an acceleration 0.02 m/s^2 when its displacement is 0.08 m. Find its time period of oscillation.

29. The frequency of the fourth harmonic in a stretched string of length 20 cm is 600 Hz. What is the velocity of the wave in the string ?
30. A brass rod of length 3 m is clamped at the centre. It emits a note of frequency 600 Hz, when it vibrates longitudinally. If the density of brass is $8.3 \times 10^3 \text{ Kg/m}^3$. Calculate the Young's modulus.
31. A load 2 kg produces a certain extension in a wire of length 6 m and diameter 1 mm. What is the lateral contraction produced if $\sigma = 0.25$ and $Y = 7.48 \times 10^{10} \text{ N/m}^2$.

(4 × 4 = 16 marks)

Section E

Write any two questions.

10 marks each.

32. What is a Cantilever ? Discuss about the depression of a beam supported at the ends and loaded at the centre.
33. Discuss the theory of forced harmonic oscillator.
34. Explain piezo electric crystal method and determination of velocity of ultrasonic waves in a liquid.
35. Obtain an expression for the velocity of longitudinal waves in gases.

(2 × 10 = 20 marks)

C 81814

(Pages : 3)

Name.....

Reg. No.....

SECOND SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION, APRIL 2020

Physics/Applied Physics

PHY 2B 02/APY 2B 02—PROPERTIES OF MATTER, WAVES AND ACOUSTICS

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all questions.

Each question carries 1 mark.

1. The relation connecting deforming force and stress is _____.
2. What is rigidity modulus ?
3. A beam rigidly fixed at one end and loaded at the other end is called a _____.
4. The maximum value of displacement is known as _____.
5. At the extreme position, the value of acceleration of a particle executing SHM is _____.
6. Give an example of damped harmonic oscillator.
7. In a simple harmonic oscillator, at what position the kinetic and potential energies become equal ?
8. What is a transverse wave ?
9. The expression of intensity of waves is _____.
10. State Sabine's reverberation formula.

(10 × 1 = 10 marks)

Section B

Answer all questions.

Write in two or three sentences.

Each question carries 2 marks.

11. What is Poisson's ratio ?
12. Obtain the equation for the period of a torsion pendulum.
13. Define SHM.
14. Write down the differential equation of a damped SHM.
15. What is the velocity of a particle executing SHM ?

Turn over

16. Give the differential equation of a three dimensional wave.
17. Write a note on noise pollution.

(7 × 2 = 14 marks)

Section C

Write any five questions.

Write in one paragraph.

Each question carries 4 marks.

18. Describe bending moment.
19. Write a note on anharmonic oscillator.
20. Describe Lissajous figures.
21. What is power dissipation ?
22. Obtain the general equation of wave motion.
23. Discuss the propagation of longitudinal waves in rods.
24. Explain reverberation.

(5 × 4 = 20 marks)

Section D

Solve any four problems.

Each question carries 4 marks.

25. A wire of 1 cm^2 area of cross section is stretched by a force to double its original length. Calculate the force. Young's modulus = 90 GPa. Assume that the wire does not break.
26. What is the frequency of a simple pendulum of 2 m long ?
27. A particle executing SHM along a straight line has a velocity 1.5 m/s at its equilibrium position and an acceleration 14.2 m/s^2 at its extreme position. Calculate its kinetic energy and potential energy when it is at a distance of 5 cm from its position. Mass of the body = 10 g.
28. The period of a moving coil galvanometer is 6.28 S. The amplitude decreases to $1/10^{\text{th}}$ of its original value in 92 seconds. Find the Q factor.
29. The longitudinal vibrations of velocity 5200 m/s are executed on a steel rod of density 7800 kg/m^3 . Calculate the Young's modulus of the material.
30. Plane harmonic waves of frequency 500 Hz are produced in air with displacement amplitude 10^{-5} m . Deduce the intensity of waves. Given density of air = 1.29 kg/m^3 and speed of sound in air = 340 m/s.

31. Calculate the twisting couple on a solid shaft of length 1.5 m and diameter 120 mm when it is twisted through an angle 0.6° . The coefficient of rigidity of the material of the shaft is $9.3 \times 10^{10} \text{ N/m}^2$.

(4 × 4 = 16 marks)

Section E

Write any two questions.

Each question carries 10 marks.

32. Explain : (a) Twisting couple on a cylinder ; (b) Determination of rigidity modulus.
33. What is a harmonic oscillator ? Derive an expression for total energy of harmonic oscillator. Give the graphical representations also.
34. Obtain an expression for velocity of transverse waves in stretched strings. Describe the modes of transverse vibrations in strings.
35. Explain the following :
- | | |
|--------------------------------|-------------------------------------|
| (a) Acoustic grating. | (b) Production of ultrasonic waves. |
| (c) Absorption coefficient and | (d) Acoustics of buildings. |

(2 × 10 = 20 marks)

C 62589

(Pages : 3)

Name.....

Reg. No.....

SECOND SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION, MAY 2019

B.Sc.—Physics/Applied Physics

PHY 2B 02/APY 2B 02—PROPERTIES OF MATTER, WAVES AND ACOUSTICS

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all questions.

1 mark each.

1. S.I. unit of Young's modulus Y is _____.
2. Write an expression for Poisson's ratio.
3. The equation for time period of a torsion pendulum is _____.
4. Write the differential equation of SHM.
5. The relation connecting time period and frequency is _____.
6. Give an example of a harmonic oscillator.
7. The total kinetic energy of a harmonic oscillator is proportional to _____.
8. Define Wave front.
9. What is pressure amplitude ?
10. Mention the unit of sound.

(10 × 1 = 10 marks)

Section B

Answer all questions.

Write in two or three sentences.

2 marks each.

11. Write a note on bending moment.
12. What is bulk modulus ?
13. Write an expression for potential energy of a harmonic oscillator.
14. What is the condition for critical damping ?
15. Give two examples of damped harmonic oscillator.
16. Obtain an expression for intensity of waves.
17. Discuss about the loudness of sound.

(7 × 2 = 14 marks)

Turn over

Section C

Write any five questions.

Write in one paragraph.

4 marks each.

18. Obtain a relation connecting three elastic constants.
19. What is quality factor ?
20. Briefly describe a forced harmonic oscillator.
21. Write a short note on anharmonic oscillator.
22. Discuss about plane progressive harmonic wave.
23. Explain Fourier's theorem.
24. Briefly describe the production of ultrasonic waves.

(5 × 4 = 20 marks)

Section D

Solve any four problems.

4 marks each.

25. Calculate the Poisson's ratio for steel. Given that Young's modulus is $2 \times 10^{11} \text{ N/m}^2$ and rigidity modulus is $8 \times 10^{10} \text{ N/m}^2$.
26. A particle having mass 4 g executes SHM. When its displacement is 8 cm, the force acting on the body is 24 gwt. Find its period.
27. The total energy of a harmonic oscillator is E. For what value of the displacement the kinetic and potential energies are equal.
28. A particle of mass 50 g moving with an initial velocity 1 m/s is acted upon by a damping force which brings it to rest in a distance of 10 cm. Calculate relaxation time.
29. Calculate the speed of transverse waves in a wire of 1 mm^2 cross-section under the tension produced by 0.1 kg weight. Density of the material = $9.8 \times 10^3 \text{ kg/m}^3$, $g = 9.8 \text{ m/s}^2$.
30. Find the frequency and period for light of wavelength 600 nm. Given $c = 3 \times 10^8 \text{ m/s}$.
31. Calculate the bulk modulus of water under a pressure of 100 atm. Initial and final volume are 100 litres and 100.5 litres respectively.

(4 × 4 = 16 marks)

Section E

Write any two questions.

10 marks each.

32. Explain how to determine Y by bending of a beam. Describe about I form of Girders.
33. Discuss about the composition of two simple harmonic motions of equal periods in a straight line.
34. What is longitudinal wave motion ? Obtain an expression for the velocity of longitudinal waves in rods.
35. Describe the following :
 - (a) Noise pollution.
 - (b) Acoustic grating.
 - (c) Reverberation.
 - (d) Applications of ultrasonic waves.

(2 × 10 = 20 marks)

D 43195

(Pages : 3)

Name.....

Reg. No.....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2018

(CUCBCSS-UG)

Physics/Applied Physics

PHY 2B 02/APY 2B 02—PROPERTIES OF MATTER WAVES AND ACOUSTICS

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all questions.

Each question carries 1 mark.

1. The apparatus used to find the rigidity modulus of the material of a wire is _____.
2. Poisson's ratio for steel if its Young's modulus is $2 \times 10^{11} \text{ N/m}^2$ and rigidity modulus is $8 \times 10^{10} \text{ N/m}^2$ is :
 - (a) 0.25.
 - (b) 0.15.
 - (c) 0.35.
 - (d) 0.1.
3. For an undamped oscillator, the quality factor is _____.
4. At what displacement, the energy of a harmonic oscillator becomes half kinetic and half potential.
5. Give one example for a damped harmonic oscillator.
6. Which of the following is not an example for linear sample harmonics motion ?
 - (a) Vibration of atoms and molecules.
 - (b) Vibration of a tuning fork.
 - (c) Oscillations of a simple pendulum.
 - (d) Oscillations of a freely suspended magnet in a uniform magnetic field.
7. The velocity of transverse waves in a stretched string is given by _____.
8. _____ is transmitted by a wave.
 - (a) Amplitude.
 - (b) Velocity.
 - (c) Energy.
 - (d) Momentum.
9. Give the expression for intensity of a sound wave when expressed in terms of pressure amplitude P_0 , velocity v and density of air ρ .
10. The phenomenon of polarization is not observed in sound because, sound is _____ wave.

(10 × 1 = 10 marks)

Turn over

Section B

*Answer all questions in two or three sentences.
Each question carries 2 marks.*

11. Define ultimate strength or the tensile strength of the wire.
12. What is meant by twisting couple ?
13. What are damped and forced oscillations ?
14. Obtain the differential equation representing the oscillations of a driven harmonic oscillator.
15. What is a plane progressive harmonic wave ?
16. State Fourier theorem.
17. State and define unit of sound intensity.

(7 × 2 = 14 marks)

Section C

*Answer any five questions in one paragraph.
Each question carries 4 marks.*

18. Derive the expression for the period of oscillation of a torsion pendulum.
19. (a) Derive an expression for the bending moment.
(b) Why the girders are I-section form ?
20. What is anharmonic oscillator ? Derive an expression for the time period of oscillation of an anharmonic oscillator.
21. Assuming the results of forced oscillations, discuss the sharpness of resonance.
22. Discuss the cases of critical damping and under damping.
23. Discuss the modes of transverse vibrations of a string.
24. What are the requirements of a good auditorium ?

(5 × 4 = 20 marks)

Section D

*Solve any four problems.
Each question carries 4 marks.*

25. A metal disc of diameter 0.1 m. and mass 1.2 kg. is fixed symmetrically to the lower end of a torsion wire of length 1 m. and diameter 1.44×10^{-3} m., the upper end of which is fixed. The time period of torsional oscillation is 1.98 seconds. Calculate the rigidity modulus of the material of the wire.
26. A metal bar 0.01 m. square in section and 0.6 m. long is firmly clamped horizontally at one end and a weight of 1.4 kg. is applied at the free end. Calculate the depression produced. Young's modulus of the material = $9.9 \times 10^{10} \text{ Nm}^{-2}$.
27. Calculate the displacement of a body executing simple harmonic motion in terms of its amplitude at which the KE = 3 × PE.

28. A body having a mass of 4 g. executes simple harmonic motion. The force acting on the body, when displacement is 8 cm., is 24 gm. wt. Find the period.
29. A particle of mass 10 g. lies in a potential field $V = 50x^2 + 100$ ergs/gm. Deduce the frequency of oscillation.
30. The frequency of the fourth harmonic in a stretched string of length 20 cm. is 600 per sec. What is the velocity of the wave in the string?
31. If the intensity of sound wave is increased by a factor of 20, by how many decibels is the sound level increased.

(4 × 4 = 16 marks)

Section E

*Answer any two questions.
Each question carries 10 marks.*

32. Obtain an expression for couple per unit twist of a wire. Explain how the rigidity modulus of a wire can be determined using a torsion pendulum.
33. Deduce the equation for the simple harmonic motion of a particle. Show that the resultant of two simple harmonic motions having the same period but different phase and amplitude are acting in the same direction on a particle is simple harmonic. What are the uses of Lissajous figures?
34. Derive an expression for a plane progressive harmonic wave. Derive the expression for energy density and energy current for such a wave.
35. What are ultrasonic waves? Explain the production of ultrasonic wave by piezoelectric crystal method. What are the applications of ultrasonic waves?

(2 × 10 = 20 marks)

C 24739

(Pages : 4)

Name.....

Reg. No.....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2017

(CUCBCSS—UG)

Core Course—Physics/Applied Physics

PHY 2B 02 / APY 2B 02—PROPERTIES OF MATTER, WAVES AND ACOUSTICS

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all questions.

1 mark each.

1. The Young's modulus of a wire of length L and radius ' r ' is $Y \text{ Nm}^{-2}$. If the length is reduced to $L/2$ and radius $r/2$, its Young's modulus will be _____.
2. The value of Poisson's ratio cannot be :
 - (a) 0.01.
 - (b) 0.1.
 - (c) 0.4.
 - (d) 0.6.
3. When the amplitude of a particle executing simple harmonic motion increases, the time period _____.
4. The maximum possible acceleration for a simple harmonic oscillator is _____.
 - (a) $\omega^2 a$.
 - (b) $\omega \sqrt{a^2 - x^2}$.
 - (c) ωa .
 - (d) ωa^2 .
5. Write an expression for the quality factor ?
6. In a simple harmonic motion, when the displacement is one half the amplitude, what fraction of the total energy is kinetic ?
 - (a) 0.
 - (b) $\frac{1}{4}$.
 - (c) $\frac{1}{2}$.
 - (d) $\frac{3}{4}$.
7. Write the relation between wave velocity and group velocity of a wave ?

Turn over

22. Obtain the expression for period of a simple pendulum.
23. Prove that variation of pressure in the case of a longitudinal progressive wave travelling through a gas is given by $P = -E \frac{dy}{dx}$.
24. Write a brief note on acoustics of buildings.

(5 × 4 = 20 marks)

Section D

*Solve any four problems.
4 marks each.*

25. Find the stress to be applied to a steel wire to stretch it by 0.25% of its original length. Young's modulus for steel is 90 GPa.
26. Find the amount of workdone in twisting a steel wire of radius 10^{-3} m and length 0.25 m through an angle of 45° . The rigidity modulus of the material of the wire is 8×10^{10} N/m².
27. A particle executing simple harmonic motion has an acceleration 0.03 m/s^2 when its displacement is 0.09 m. Find the time period of oscillation ?
28. A particle in simple harmonic motion has velocity values 6 m/s and 5 m/s when its distance from the equilibrium positions are 2 cm and 3 cm respectively. Find the amplitude and frequency of oscillation ?
29. If the potential energy of a harmonic oscillator in its resting position is 5 joules and the total energy is 9 joules, when the amplitude is 1 m, what is the force constant ? If its mass is 2 kg, what is the period ?
30. If in air, a plane wave of frequency 256 Hz and amplitude $\frac{1}{1000}$ mm is produced, calculate the radiated energy per unit volume and the energy current. Density of air = 1.29 kg/m^3 and velocity of sound in air is 332 m/s.
31. Calculate the change in intensity level when the intensity of sound increases 100 times its original intensity.

(4 × 4 = 16 marks)

Turn over

Section E

Write any two questions.

10 marks each.

32. With relevant theory, explain how the Young's modulus of the material of a cantilever can be determined?
33. Deduce the differential equation for a damped harmonic oscillator and discuss in the cases of critical damping and under damping.
34. State Fourier's theorem. Give the conditions for the applicability of Fourier's theorem. Apply it to a sawtooth wave.
35. Discuss the production, properties and applications of ultra sonics. How are they detected?

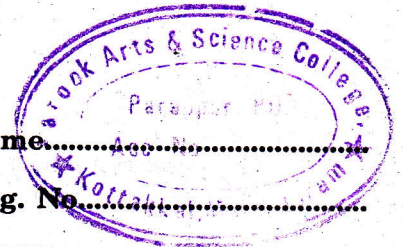
(2 × 10 = 20 marks)

C6128

(Pages : 4)

Name.....

Reg. No.....



**SECOND SEMESTER B.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION
MAY 2016**

(UG—CCSS)

Core Course—Physics

PH 2B 03—PROPERTIES OF MATTER, WAVES AND ACOUSTICS

(2013 Admissions)

Time : Three Hours

Maximum : 30 Weightage

Part A

Answer all questions.

- When an elastic material with Young's modulus Y is subjected to a stretching stress x , the elastic energy stored per unit volume is :
(a) $2y/x$. (b) $x^2/2y$.
(c) $y^2/2x$. (d) $2x/y^2$.
- The breaking stress for a wire of radius r of steel is $F \text{ N/m}^2$. The breaking stress for the wire of the same material of radius $2r$ is :
(a) $F/2$. (b) $2F$.
(c) F . (d) $4F$.
- A material has Poisson's ratio $\sigma = 0.5$. If a uniform rod of it suffers a longitudinal strain of 2×10^{-3} , the percentage change in volume is :
(a) 0.2. (b) 0.6.
(c) 0.4. (d) Zero.
- In a beam the line of intersection of the plane of bending with the neutral surface is known as _____.
- A person measures the period of a simple pendulum inside a stationary lift and finds it to be T . If the lift starts accelerating upwards with an acceleration of $g/3$, the time period of the pendulum will be :
(a) $\frac{\sqrt{3} T}{2}$. (b) $\sqrt{3} T$.
(c) $\frac{T}{\sqrt{3}}$. (d) $\frac{2T}{\sqrt{3}}$.

$2\pi \sqrt{\frac{l}{g}}$
 $= \frac{g+g/3}{g}$

Turn over

6. The potential energy U of a simple harmonic oscillator when the particle is half way to its end position is :
- (a) U . (b) $U/4$.
(c) $U/2$. (d) $3U/2$.
7. The motion of a particle executing SHm, is given by $x = 0.01 \sin 100 \pi (t + .05)$ where x is in meter and t in second. The period is :
- (a) .01 sec. (b) 0.1 sec.
(c) 0.02 sec. (d) 0.2 second.
8. A tone which has a frequency that is an integral multiple of the fundamental frequency is known as :
- (a) Fundamental mode. (b) Harmonic.
(c) First overtone. (d) None of these.
9. Ripples on the surface of water is an example of :
- (a) Non-mechanical waves. (b) Transverse waves.
(c) Electromagnetic waves. (d) Longitudinal waves.
10. With the propagation of a longitudinal wave through a material medium the quantities transmitted in the propagation direction are :
- (a) Energy, momentum and mass. (b) Energy, and mass.
(c) Energy. (d) Energy and linear momentum.
11. The velocity of sound is maximum in :
- (a) Water. (b) Vacuum.
(c) Metal. (d) Air.
12. The walls of the hall built for music concerts should be :
- (a) Amplify sound. (b) Absorb sound.
(c) Reflect sound. (d) Reverberate.

(12 × ¼ = 3 weightage)

Part B

Answer all questions.

13. What do you mean by braking stress ?
14. Define rigidity modulus of a material.
15. Why is a cantilever of uniform cross section more likely to break near the fixed end ?
16. How is the period of a simple pendulum affected if its amplitude of motion is large ?
17. What is relaxation time ?
18. What is a plane progressive wave ? Give an example.
19. Distinguish between wave velocity and phase velocity.
20. Define decibel and Bel.
21. What is acoustic grating ?

(9 × 1 = 9 weightage)

Part C

Answer any five questions.

Each question carries 2 weightage.

22. Prove that the strain energy per unit volume is $\frac{1}{2}$ stress × strain. What is the work done in stretching a wire of cross section one square mm. and length 2 m. through 0.1 mm. ?
23. Explain bending moment. A steel wire of diameter 2 mm. is bend as a circle of radius 10 cm. Calculate the bending moment if $Y = 2 \times 10^{11} \text{ N/m}^2$.
24. What is the criteria for a periodic motion to be simple harmonic ? A horizontal platform with an object placed on it is executing SHM in the vertical direction. If the amplitude of oscillation is 2.5cm. what must be the least period of these oscillations so that the object is not detached from the platform ?
25. What are torsional oscillations ? A 2kg. mass extends of a spring by 10cm. from its unstretched position. The mass is replaced by a body of mass 80gm. which is pulled and released. Calculate the period of oscillation.

Turn over

26. On what factors does the velocity of longitudinal waves in a rod depend? Calculate the wavelength of longitudinal waves of frequency 512 Hz in an alloy of density 5400 kg/m^3 and $y = 8.9 \times 10^{10} \text{ N/m}^2$.
27. What is reverberation? How can it be minimized?
28. Prove that the total mechanical energy of a harmonic oscillator is a constant. Also show that the average KE of a harmonic oscillator equals the average PE.

(5 × 2 = 10 weightage)

Part D

Answer any two questions.

Each question carries 4 weightage.

29. What is a cantilever? Derive an expression for the depression at the free end of a cantilever in the form of: (a) Rectangular cross and (b) Circular cross section.
30. What are damped oscillations? Discuss over damping, critical damping and under damping. Give examples.
31. What is Piezo electric effect? Describe how the velocity of ultrasonic waves in a liquid is determined.

(2 × 4 = 8 weightage)

C 5598

(Pages : 3)

Name.....

Reg. No.....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2016

(CUCBCSS—UG)

Core Course—Physics/Applied Physics

PHY 2B02/APY 2B02—PROPERTIES OF MATTER WAVES AND ACOUSTICS

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all questions.

1. The bending moment needed to produce a curvature of unit radius in a beam is called _____.
2. The potential energy of a body executing simple harmonic motion is zero at _____ position.
3. Sound travels _____ in humid air.
4. The intensity of loudest sounds that the ear can tolerate without pain is called the _____ of pain.
5. What is Q-factor ?
6. What is Decibel ?
7. What is sharpness of resonance ?

State whether the statement is True or False (8-10).

8. For any kind of strain, work done per unit volume is equal to $\left(\frac{1}{2}\right) \times \text{stress} \times \text{strain}$.
9. The potential energy of a particle executing SHM, at its extreme position is maximum.
10. The pressure amplitude of sound is proportional to the displacement amplitude.

(10 × 1 = 10 marks)

Section B

Answer all questions.

Write in one or two sentences.

11. Define Poisson's ratio. What are its limiting values ?

Turn over

12. Explain why girders are of I-shape ?
13. Define SHM. Obtain the differential equation of SHM.
14. Show that the total energy of a harmonic oscillator is equal to its maximum kinetic energy.
15. What are the characteristics of plane progressive wave ?
16. What is fundamental frequency ?
17. What are ultrasonics ?

(7 × 2 = 14 marks)

Section C

Answer any five questions.

Write in one paragraph.

18. Derive an expression for the depression at the end of a loaded cantilever.
19. Show that shearing stress is equivalent to an equal tensile stress and an equal compressive stress at right angles to each other.
20. Derive an expression for the period of oscillation of two particles connected by a spring.
21. Show that simple harmonic motion may be expressed as either a sine or a cosine function, there being only a difference in initial phase in the two cases.
22. Distinguish between forced oscillations and damped oscillations.
23. What are ultrasonic waves ? How are they produced ?
24. Explain the importance of Fourier's series in acoustics.

(5 × 4 = 20 marks)

Section D

Solve any four problems.

25. Two wires made of the same material are subjected to forces in the ratio 1 : 2. Their lengths are in the ratio 8 : 1. Find the ratio of their extension.
26. When a wire of length 5 m. and diameter 1 mm. was stretched by a load of 5 kg, the elongation produced in the wire was 1 mm. Find the energy stored in per unit volume of the wire.

27. The acceleration due to gravity on the surface of moon is 1.7 ms^{-2} . What is the time period of a simple pendulum on the moon if its time period on the earth is 3.5 s? (g on the earth molecule if the fundamental = 9.8 ms^{-2}).
28. Calculate the effective force constant for the coupling forces between the atoms HCl molecules if the fundamental frequency of vibration of the molecule is $8.7 \times 10^{13} \text{ Hz}$. Reduced mass of HCl molecule is 0.97 amu.
29. A string vibrates with frequency 200 Hz. Its length is doubled and its tension is altered until it begins to vibrate with frequency 300 Hz. What is the ratio of the new tension to the original tension?
30. The maximum variation in pressure P that the ear can tolerate in loud sound is about 28 Nm^{-2} . What is the corresponding maximum displacement for a sound of frequency 500 Hz in air. Density of air 1.22 kgm^{-3} and velocity of sound 330 ms^{-1} .
31. Calculate the percentage change in intensity when the intensity level is changed by 1 dB.

(4 × 4 = 16 marks)

Section E

Answer any two questions

32. Show that a shearing stress is equivalent to an equal tensile stress and an equal compressive stress at right angles to each other.
33. Explain damped harmonic motion. Obtain the differential equation for damped harmonic oscillation. Discuss the solution and explain the terms :
- (i) Under damped.
 - (ii) Over damped ; and
 - (iii) Critically damped motions.
34. Derive an expression for the velocity of longitudinal waves in a gas.
35. What is piezo-electric effect ? Explain how ultrasonic waves are produced using this effect.

(2 × 10 = 20 marks)

**SECOND SEMESTER B.Sc. DEGREE [SUPPLEMENTARY/IMPROVEMENT]
EXAMINATION, APRIL/MAY 2015**

(UG—CCSS)

Core Course—Physics

PH 2B 03—PROPERTIES OF MATTER WAVES AND ACOUSTICS

(2013 Admissions)

Time : Three Hours

Maximum : 30 Weightage

Part A

Answer all questions.

1. When an elastic material with Young's modulus Y is subjected to a stretching stress x , the elastic energy stored per unit volume is :

(a) $\frac{2y}{x}$

(b) $\frac{x^2}{2y}$

(c) $\frac{y^2}{2x}$

(d) $\frac{2x}{y^2}$

2. A spring of force constant k is cut into two equal parts. The force constant of each part is :

(a) $2K$.

(b) $\frac{K}{2}$.

(c) $\frac{K^2}{2}$.

(d) $4K$.

3. A material has Poisson's ratio $\sigma = 0.5$. If a uniform rod of it suffers a longitudinal strain of 2×10^{-3} , the percentage change in volume is :

(a) 0.2.

(b) 0.6.

(c) 0.4.

(d) Zero.

4. Which of the following substance has the highest elasticity ?

(a) Sponge.

(b) Copper.

(c) Steel.

(d) Rubber.

5. A person measures the period of a simple pendulum inside a stationary lift and finds it to be T . If the lift starts accelerating upwards with an acceleration of $g/3$, the time period of the pendulum will be :

(a) $\frac{\sqrt{3}}{2} T$.

(b) $\frac{T}{2}$.

(c) $2T$.

(d) T .

Turn over

6. A circuit contains $L = 10\text{mH}$, $C = 1\mu\text{F}$ and $R = 1\Omega$. The frequency of damped oscillators in radius/sec is :
- (a) 10^2 . (b) 10^3 .
(c) 10^4 . (d) 10^5 .
7. The motion of a particle executing SHM, is given by $x = 0.01 \sin 100 \pi(t + .05)$ where x is in meter and t in second. The period is :
- (a) .01 sec. (b) 0.1 sec.
(c) 0.02 sec. (d) 0.2 sec.
8. A damped oscillator loses 4% of its energy in each cycle. The cycle elapse before half of its initial energy dissipated is :
- (a) 8.6. (b) 21.4.
(c) 11.3. (d) 17.3.
9. Ripples on the surface of water is an example of :
- (a) Non mechanical waves. (b) Transverse waves.
(c) Electromagnetic waves. (d) Longitudinal waves.
10. When a compression is incident on rigid wall it is reflected as :
- (a) Compression with a phase change of π .
(b) Compression with no phase change.
(c) Rarefaction with a phase change π .
(d) Rarefaction with no phase change.
11. The velocity of sound is maximum in :
- (a) Water. (b) Vacuum.
(c) Metal. (d) Air.
12. The minimum audible wavelength at room temperature is approximately :
- (a) 0.2 A degree. (b) 5 A degrees.
(c) 5 cm to 2 meter. (d) 20 mm.

(12 × ¼ = 3 weightage)

Part B

Answer all questions.

13. What do you mean by braking stress ?
14. What is plasticity ?
15. Why is a cantilever of uniform cross section more likely to break near the fixed end ?
16. What does the mechanical energy of an oscillating particle consist of ?
17. What is relaxation time ?
18. Give *two* effects of damping.

19. Distinguish between wave velocity and phase velocity.
20. What are the factors governing loudness of sound ?
21. What is acoustic grating ?

(9 × 1 = 9 weightage)

Part C

*Answer any five questions.
Each question carries 2 weightage.*

22. Prove that the strain energy per unit volume is $\frac{1}{2}$ stress \times strain. What is the work done in stretching a wire of cross section one square mm and length 2m through 0.1 mm. $Y = 2 \times 10^{11} \text{ N/m}^2$.
23. What is the criteria for a periodic motion to be simple harmonic ? A horizontal platform with an object placed on it is executing SHm in the vertical direction. If the amplitude of oscillation is 2.5 cm what must be the least period of these oscillations so that the object is not detached from the platform ?
24. Explain what is meant by anharmonic oscillations. How are the anharmonic terms calculated ?
25. What are torsional oscillations ? A 2 kg mass extends of a spring by 10 cm from its unstretched position. The mass is replaced by a body of mass 80 gm which is pulled and released. Calculate the period of oscillation.
26. Derive an expression for the energy density of a plane progressive wave.
27. What is reverberation ? How can it be minimized ?
28. What are ultrasonic waves ? A quartz crystal of thickness 1 mm is vibrating at resonance. What is the fundamental frequency of vibration if Young's modulus of quartz is :
 $7.9 \times 10^{10} \text{ N/m}^2$ and density = $2.65 \times 10^3 \text{ kg/m}^3$.

(5 × 2 = 10 weightage)

Part D

*Answer any two questions.
Each question carries 4 weightage.*

29. What is a cantilever ? Derive an expression for the depression at the free end of a cantilever in the form of : (a) Rectangular cross ; and (b) Circular cross section.
30. Describe a method of determining the rigidity modulus of a wire using torsion pendulum. Derive the necessary theory.
31. Obtain the differential equation of a vibrating string and hence derive the expression for the fundamental frequency of vibration. A wire of mass 1 gm and length 75 cm is vibrating with a frequency of 256 Hz under a certain tension. Estimate the mass attached to the wire that causes the tension.

(2 × 4 = 8 weightage)

C 82977

(Pages : 3)

Name.....Ajha.C.....

Reg. No.....F.P.A.C.S.P.H.S.C......

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2015

(CUCBCSS-UG)

Core Course—Physics

PH 2B 02—PROPERTIES OF MATTER, WAVES AND ACOUSTICS

Time : Three Hours

Maximum : 80 Marks

Part A

Answer all questions.

Each question carries 1 mark.

1. The substance which shows practically no elastic after effect is _____.
 2. Elastic forces are _____ forces.
 3. Damping _____ the frequency of oscillations.
 4. What does the mechanical energy of a oscillating particle consist of ?
 5. If the disturbance or state of motion is continuously transmitted along the same direction, it is called a _____.
 6. Antinodes are points at which the value of _____.
 7. The walls of the halls built for music concerts should _____.
- Check whether the following statements are True/False :-
8. For a material the Poisson's ratio is a dimensionless constant.
 9. The frictional force in damped oscillations is not proportional to the velocity of the system.
 10. Decibel is a measure of sound level.

(10 × 1 = 10 marks)

Part B

Answer all questions in two or three sentences each.

Each question carries 2 marks.

11. When is a body said to be perfectly elastic ?
12. What is meant by elastic fatigue ?
13. What is meant by restoring force ?
14. What is damping ? Give its effect ?

Turn over

15. Obtain the general equation of wave motion.
16. What are results of reflection of sound waves from rigid free boundary ?
17. Why are Girders designed in the shape of I ?

(7 × 2 = 14 marks)

Part C

*Answer any five questions.
Each question carries 4 marks.*

18. Explain the terms :
- | | |
|------------------|---------------------|
| (a) Elasticity. | (b) Elastic limit. |
| (c) Yield point. | (d) Breaking point. |
19. Explain the terms :
- | | |
|----------------------|-----------------------|
| (a) Neutral surface. | (b) Plane of bending. |
| (c) Neutral axis. | (d) Bending moment. |
20. What is a coupled oscillator ? What are normal coordinates and normal modes of a coupled system ? Give its significance.
21. What is an harmonic oscillator ? Discuss a large amplitude pendulum as an harmonic oscillator.
22. Explain what is meant by a forced harmonic oscillator. Define resonant frequency. What is sharpness of resonance ?
23. Prove with theory that the velocity longitudinal waves in a rod depends on the Young's modulus and density of the material.
24. What is reverberation ? Explain the causes of reverberation in a hall. How can it be minimized ?

(5 × 4 = 20 marks)

Section D

*Answer any four questions.
Each question carries 4 marks.*

25. Find the work done in joules in stretching a wire of cross section 1sq : mm and length 2 metre through 0.1 mm. Young's modulus of wire is 2×10^{11} N/m².
26. A copper wire 3 m long and 1mm diameter has an Young's modulus of 12.5×10^{10} N/m². What extension will be produced if a weight of 10 kg is attached to one end of the wire after fixing the other end ? What will be the lateral strain ? ($\sigma = 0.26$)
27. A particle executing SHM has a maximum displacement of 4 cm and its acceleration at a distance of 1 cm from the mean position is 3 cm/sec². What will be its velocity when it is at a distance of 2 cm from the mean position ?
28. A forced harmonic oscillator shows equal amplitude of oscillations at frequencies $\omega = 300$ rad/sec and $\omega = 400$ rad/sec. Calculate the resonance frequency ω_R at which the amplitude becomes maximum.

- A train of sound waves is propagated along a wide pipe and it is reflected from an open end. If the amplitude of the waves is 2×10^{-5} m and frequency 1000 Hz and wave length 40 cm, calculate the amplitude of vibration at a point 10cm from the open end inside the pipe.
30. A sitar wire is under a tension of 30 N and the length of the bridges is 0.8m. Calculate the speed of transverse waves on the wire and the fundamental frequency of vibration. 10 meter of sitar wire weighs.
31. The entry of people in an auditorium of volume 160000 cube meter and total absorption of 1000 square meter of open window raises the absorption by 600 square meter. Find the change in reverberation time.

(4 × 4 = 16 marks)

Part E

*Answer any two questions.
Each question carries 10 marks.*

32. Derive the relation connecting Young's modulus Y , rigidity modulus η and Poisson's ratio σ .
33. What is a compound pendulum? Derive an expression for the period of oscillation. Show that the centers of suspension and oscillation are mutually interchangeable.
34. What are damped oscillations? Discuss over damping, critical damping and under damping. Calculate the power loss in a damped oscillator.
35. Derive an expression for the velocity of transverse waves in a stretched uniform string.

(2 × 10 = 20 marks)

5. The amplitude of a damped oscillator becomes $\frac{1}{2}$ after t second. If the amplitude becomes $\frac{1}{4}$ after $3t$ second, then x is equal to :
- (a) 0.8. (b) 8.
(c) 0.4. (d) 4.
6. A particle executing S.H.M. has amplitude of 1 m and time period 2 s. The velocity when displacement being 0.5 m is :
- (a) 2.72 ms^{-1} . (b) 7.22 ms^{-1} .
(c) 2.27 ms^{-1} . (d) Zero.
7. A pipe open at both ends produced a note of frequency f_1 . When the pipe is kept with $\frac{3}{4}$ th of its length in water, it produces a note of frequency f_2 . The ratio of f_1 / f_2 is :
- (a) $\frac{1}{2}$. (b) 2.
(c) $\frac{3}{4}$. (d) $\frac{4}{3}$.
8. An empty vessel is partially filled with water. The frequency of vibration of air column in the vessel :
- (a) Depends on the purity of water. (b) Remains the same.
(c) Decreases. (d) Increases.
9. Sound waves are :
- (a) Transverse.
(b) Longitudinal.
(c) Present in transverse and longitudinal forms.
(d) None of the above.
10. The maximum value of wavelength of ultrasonic wave is :
- (a) 33 cm. (b) 165 cm.
(c) 1.65 cm. (d) 20 cm.
11. An auditorium of dimensions $(100 \times 40 \times 10) \text{ m}^3$ contains 1000 m^2 curtains of absorption coefficient 0.7 m^{-2} . If 1000 men of absorption coefficient 0.9 per person are sitting in the hall, the reverberation time is :
- (a) 2.7 s. (b) 7.2 s.
(c) 3.5 s. (d) 3.7 s.

III. Answer any *two*, each question carries 4 weightage :

- 29 With necessary theory explain torsional oscillation of a torsion pendulum and derive an expression for the rigidity modulus of a thin wire.
- 30 What is forced harmonic oscillator ? Discuss the theory of forced harmonic oscillator. Explain the different cases.
- 31 Discuss any one method of production of ultrasonic waves. Describe an experiment to determine velocity of ultrasonic waves in a liquid.

(2 × 4 = 8 weightage)

- II. 5 When a shaft is subjected to a twisting moment, every cross-section of the shaft will be under ?
- (a) Tensile stress. (b) Compressive stress.
(c) Shear stress. (d) All of these.
- 6 The displacement $y(x, t)$ of a particular travelling wave has the form :
 $y(x, t) = A \sin[x + (\pi t / 2)]$. What is the speed of its motion . Ignore its direction ?
- (a) $\pi/2$. (b) 2π .
(c) 4π . (d) None of the above.
- 7 If you put your finger tip in a pool of water and repeatedly move it up and down, you will create circular water waves that move out from that point. What will happen to the wavelength of these waves if you move your finger up and down more slowly ?
- (a) Decrease. (b) Increase.
(c) Remain the same. (d) None of the above.
- 8 If the distance between the listener and the source of the sound is doubled, the intensity is reduced to :
- (a) $1/2$. (b) $1/3$.
(c) $2/3$. (d) $1/4$.
- III. 9 What is the S. I. unit of torsional rigidity ?
- (a) Nm. (b) Nm^2 .
(c) Nm/ radian. (d) None of the above.
- 10 A "periodic function" is given by a function which :
- (a) Has a period $T = 2\pi$. (b) Satisfies $f(t + T) = f(t)$.
(c) Satisfies $f(t + T) = -f(t)$. (d) Has a period $T = \pi$.
- 11 Time a sound wave having frequency 2 KHz and wavelength 35 cm requires to cover distance of 1.5 Km is :
- (a) 10 s. (b) 20 s.
(c) 2.1 s. (d) 8 s.
- 12 A particle executes SHM with frequency f . Then its kinetic energy oscillates with frequency :
- (a) f . (b) $f/2$.
(c) $2f$. (d) $4f$.

(3 × 1 = 3 weightage)

Section B

Answer all questions, each has weightage 1.

- 13 Define 'Poisson's ratio'. What are its limiting values ?
- 14 Why girders are made in 'I' forms ?
- 15 Define the term Quality factor of a damped harmonic oscillator.
- 16 Write down the differential equation for a plane progressive wave with symbols explained.
- 17 Distinguish between 'musical sound' and 'noise'.
- 18 Define 'decibel' unit of sound
- 19 What are Lissajous figures ?
- 20 Give an expression for the velocity of a transverse waves in a stretched string. Explain the symbols used.
- 21 What is 'acoustic grating' ?

(9 × 1 = 9 weightage)

Section C

Answer any five, each has weightage 2.

- 22 A thick uniform rubber rope of density 1500 kg/m^3 and Young Modulus $5 \times 10^6 \text{ Nm}^{-2}$ has a length 8m. when hung from the ceiling of the room. What should be the increase in length due to its own weight ?
- 23 Derive a relation for the bending moment of a rectangular beam.
- 24 Find the Fourier co-efficient A_0 for the function $f(x) = L - x$ on $-L \leq x \leq L$.
- 25 Write a short note on Piezo electric crystal method for the production of ultrasonic waves.
- 26 Discuss the factors controlling the acoustics of a building.
- 27 A wire of 4 meter long 0.3 mm in diameter is stretched by a force of 8 Kgw. If the extension in length is 1.5 mm , calculate the energy stored in the wire.
- 28 Define dB unit of sound intensity. The threshold of hearing is 0 dB corresponding to a sound intensity of 10^{-12} W/m^2 . The sound intensity of 'jet take off' is 140 dB. Determine the ratio of the two sound intensities.

(5 × 2 = 10 weightage)

Turn over

Section D

Answer any two, each has weightage 4.

- 29 Derive the expression for the depression at the free end of a cantilever having rectangular area of cross section.
- 30 Derive an expression for the velocity of transverse waves in a stretched string.
- 31 Write and explain Sabine's formula for the acoustics of buildings. Discuss various methods to improve the acoustics of an auditorium.

(2 × 4 = 8 weightage)

C 25887

(Pages : 2)

Name.....

Reg. No.....

**SECOND SEMESTER B.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION
APRIL 2017**

(UG—CCSS)

Physics

PH 2B 03—PROPERTIES OF MATTER WAVES AND ACOUSTICS

(2009—2012 Admissions)

Time : Three Hours

Maximum : 30 Weightage

Part A

Answer all questions.

Each question carries $\frac{1}{4}$ weightage.

1. The ratio of the volume stress to the volume strain is called _____.
2. The modulus of rigidity of a liquid is _____.
3. Young's modulus of a material of a wire is Y. If it is under a stress S, the energy stored per unit volume is given by _____.
4. LCR circuit is an example of a _____ oscillator.
5. The oscillations of a simple pendulum is _____.
6. Give the differential equation for SHM.
7. The ratio of intensity of wave and energy density gives _____.
8. Write the expression for the depression of the free end of the cantilever.
9. The audible limit of sound wave is in between _____.
10. Piezo-electric crystal method is used for the production of _____.
11. When K.E of an SHM is zero , P.E is _____.
12. State Hook's law.

(12 \times $\frac{1}{4}$ = 3 weightage)

Part B

Answer all questions.

Each question carries 1 weightage.

13. What is Poisson's ratio ?
14. What are I- section girders ?

Turn over

15. Discuss the characteristics of SHM.
16. Graphically represent the variation of P.E and K.E of a simple harmonic oscillator.
17. Give two uses of Lissajous figures.
18. Explain resonance.
19. State Fourier theorem.
20. Distinguish between longitudinal and transverse waves.
21. Write two applications of ultrasonic waves.

(9 × 1 = 9 weightage)

Part C

Answer any five questions.

Each question carries 2 weightage.

22. Find the amount of work done in twisting a steel wire of radius 10^{-3} m and length 0.25 m through an angle of 45° . Given rigidity modulus for steel is $8 \times 10^{10} \text{ Nm}^{-2}$.
23. The free end of a cantilever of circular cross-section when loaded with 500 g is depressed by 1 cm. Find the mass required for producing the same depression for another rod of same material but double the length and double the radius.
24. Calculate Poisson's ratio for steel, given that its Young's modulus is $2 \times 10^{11} \text{ Nm}^{-2}$ and Rigidity modulus $8 \times 10^{10} \text{ Nm}^{-2}$.
25. The frequency of a tuning fork is 300 Hz. If the quality factor Q is 5×10^4 , after which its energy becomes 1/10th of its initial value.
26. Derive expression for the couple required to twist a cylinder through an angle θ .
27. Show that the velocity of a transverse wave along a string is $v = (T/m)^{1/2}$.
28. Show that for a harmonic oscillator average P.E over a cycle is equal to the average K.E. over a cycle.

(5 × 2 = 10 weightage)

Part D

Answer any two questions.

Each question carries 4 weightage.

29. Derive an expression for bending moment.
30. What is a damped harmonic oscillator? Derive its equation of motion and obtain its solution. Also explain over-damped motion, critically damped motion and under damped oscillatory motion.
31. Discuss the important factors affecting the acoustic of a building.

(2 × 4 = 8 weightage)