D 113934 **(Pages : 2)** **Name.....**

Reg. No.....

FIRST SEMESTER (CBCSS–UG) DEGREE EXAMINATION, NOVEMBER 2024

Physics/Applied Physics

PHY 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

(2019–2023 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A – Short Answer Type

Answer **all** *questions in two or three sentences, each correct answer carries a maximum of 2 marks*

1. What is the difference between angle of stress and angle of shear. Give the relationship between the two.
2. Give the Meyer's formula for gaseous flow through a capillary tube.
3. Write down the expressions for geometrical moment of inertia of beams of rectangular and circular cross sections.
4. Distinguish between adiabatic work and isothermal work.
5. Explain the significance of Reynolds number in fluid flow.
6. Explain the connection between entropy and disorder.
7. Why do clouds appear to us to be floating?
8. Apply the first law of thermodynamics to isobaric and isochoric processes.
9. What is a V-T diagram?. Draw V-T diagrams for isothermal and isobaric processes.
10. What causes the random motion of particles observed in Brownian motion?
11. Explain the term coefficient of performance of a refrigerator.
12. Can the internal energy of an isolated system change ? Explain.

(Ceiling 20)

Turn over

Section B - Paragraph / Problem type

Answer **all** *questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks.*

13. Calculate the energy needed to break a liquid drop of radius 'R' and surface tension T' into n equal small drops.

14. Calculate the change in melting point of naphthalene for 2 atmospheres rise in pressure, given that its melting point is 80°C. Latent heat of fusion is 4563 cal/mol and increase in volume on fusion is 13.7 cm^3/mol. Given $1\,\text{cal} = 4.2\times10^7$ ergs.

15. Discuss the determination of rigidity modulus of a wire using torsion pendulum.

16. Air kept at a constant pressure of 5 atmospheres is allowed to escape through a tube of length 10 m and radius 5 mm. Calculate the rate at which the gas escapes. Given coefficient of viscosity of air is $1.8325\times10^{-5}\,\text{N}s\,m^{-2}$.

17. Show that the transverse vibrations of a loaded cantilever are simple harmonic in nature and drive the expression for the period of oscillation.

18. Show that loss of available energy = (gain in entropy) × T_0.

19. Calculate the entropy change when 1 Kg of ice at 250K is converted to water at 300K. Given specific heat capacity ice $2100\,\text{J/Kg.K}$ and latent heat of fusion of $_{\text{ice}} = 336\times10^3\,\text{J}/kg$.

(Ceiling 30)

Section C - Essay type

Essays - Answer in about two pages, any **one** *question. Answer carries 10 marks.*

20. Show that the entropy change in a carnot cycle is zero. Also show that during an irreversible process, there is only a net outflow of heat from the system.

21. Derive expressions for the excess of pressure for (a) spherical liquid drop in air, (b) an air bubble formed in the liquid and (c) an air bubble formed by the liquid film in air.

(1 × 10 = 10 marks)

D 53687 **(Pages : 2)** **Name.....**

Reg. No.....

FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2023

Physics

PHY 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

(2019—2023 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A (Short Answer Type)

Answer **all** *questions in two* **or** *three sentences.*
Each correct answer carries a maximum of 2 *marks.*

1. Write down the units of :
   (i) Stress.
   (ii) Strain.
   (iii) Modulus of Elasticity.
2. Define rigidity modulus of elasticity
3. What is a torsion pendulum ?
4. What is meant by entropy ?
5. What is thermodynamic system ?
6. What are thermodynamic co-ordinates ?
7. Define co-efficient of viscosity.
8. Explain terminal velocity.
9. Write down Stokes law and explain the symbols used.
10. Mention three applications of Stokes law.
11. What is Isobaric process ?
12. State Carnot's theorem.

(Ceiling 20)

Turn over

Section B (Paragraph / Problem Type)

Answer **all** *questions in* **a paragraph** *of about* **half a page to full page.**
Each correct answer carries a maximum of 5 *marks.*

13. Define isobaric process with equation.

14. Derive the equation for work done in a torsion pendulum.

15. Derive an expression for the period oscillation of a torsion pendulum.

16. A steel tap is stretched so that its length is 0.001 % of its initial line. If Y = 200 GPa, Calculate the stress required.

17. a) What is isothermal process ?

    b) Calculate the work done in compressing 2 mole of an ideal gas kept at a constant temperature of 20°C from a volume of 4 litre to 1 litre.

18. Derive the equation for work done by a hydrostatic system.

19. Show that the work done by a hydrostatic system in an adiabatic process is $W = nR\left(T_f - T_i\right)$.

(Ceiling - 30)

Section C (Essay Type)

Essays.
Answer in about **two pages**, *any* **one** *question.*
Answer carries 10 *marks.*

20. Define Viscosity. Derive the Poiseuille's equation for the rate of flow of a liquid through a capillary tube.

21. Define adiabatic and isothermal bulk modulus of elasticity. Show that adiabatic bulk modulus of elasticity of a perfect gas is Y times its isothermal bulk modulus of elasticity.

(1 × 10 = 10 marks)

D 32383 **(Pages : 2)** **Name.....**

Reg. No.....

FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2022

Physics/Applied Physics

PHY 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

(2019—2022 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A (Short Answer Type)

Answer **all** *questions in two* **or** *three sentences.*
Each correct answer carries a maximum of 2 *marks.*

1. Explain elasticity.
2. State Hooks Law.
3. What is Poisson's ratio ?
4. What is a Cantilever ?
5. What are thermodynamic co-ordinates ?
6. Explain I section girders.
7. What is angle of contact ?
8. What is Viscosity ?
9. Why small drops are spherical in shape ?
10. What is meant by efficiency of a heat engine ?
11. State Clausius statement of second law of thermodynamics.
12. State Clausius-Clapyron equation.

(Ceiling 20)

Turn over

Section B (Paragraph/Problem Type)

Answer **all** *questions in* **a paragraph** *of about* **half a page to full page**.
Each correct answer carries a maximum of 5 *marks.*

13. Write notes on 1) Brownian motion ? 2) Viscosity of gases.

14. Derive the relation connecting moduli of elasticity and Poisson's ratio.

15. Derive the expression for the couple required to twist a cylinder through an angle θ.

16. A rod of rectangular cross section having breadth 2 cm and thickness 1 cm is bent in the form of an are of radius 10 m. If Young's modulus is $10^{10} N/m^2$, find (a) Stress and strain on convex surface, (b) Bending moment.

17. Describe Stoke's method of determination of co-efficient of viscosity.

18. Find the change in internal energy of a gas if its volum increases from 3.5 to 4.2 litre at a constant pressure of atmosphere on giving 320 J of heat.

19. Entropy is a point (state) function and not a path function. Explain. How is entropy change calculated ?

(Ceiling 30)

Section C (Essays)

Answer in about **two pages,** *any* **one** *question.*
Answer carries 10 *marks.*

20. What is bending moment ? Derive an expression for bending moment.

21. Calculate the work done by a hydrostatic system in isothermal, adiabatic, isochoric and isobaric processes.

(1 × 10 = 10 marks)

D 13612 **(Pages : 2)** **Name.....**

Reg. No.....

FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION, NOVEMBER 2021

Physics/Applied Physics

PHY 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

(2019 to 2020 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A (Short Answer Type)

Answer **all** *questions in two* **or** *three sentences.*
Each correct answer carries a maximum of 2 *marks.*

1. Define young's modulus of elasticity.
2. Derive the theoretical limits of Poisson's ratio.
3. What is stress ? What is its unit ?
4. What is surface tension ?
5. Explain the terms Neutral surface and Neutral axis.
6. What is a torsion pendulum ?
7. Explain the concept of heat and temperature.
8. State first law thermodynamics.
9. What do you mean by isothermal elasticity ?
10. What is a refrigerator ?
11. What is its coefficient of performance ?
12. Why thermodynamic temperature is called the absolute temperature ?

(Ceiling 20)

Section B (Paragraph/Problem Type)

Answer **all** *questions in a paragraph of about* **half a page to full page.**
Each correct answer carries a maximum of 5 *marks.*

13. The excess of pressure inside a soap bubble of radius 1 mm is equal to balance a liquid column of height 2.09 cm. Calculate the density of the liquid. Given surface tension of soap solution is 0.04N/m.
14. Calculate the work done in blowing a bubble.

Turn over

15. Derive an expression for the excess pressure inside a spherical drop.

16. Show that the isothermal bulk modulus of elasticity of a perfect gas is P.

17. State and explain Kelvin-Planck statement of second law of thermodynamics.

18. Write and prove Carnot's theorem.

19. Write down Stokes law and explain the symbols used. Mention three applications of Stokes law.

(Ceiling 30)

Section C (Essay Type)

Answer in about **two pages**, *any* **one** *question.*
Answer carries 10 *marks.*

20. Define coefficient of viscosity. Describe Poiseuille's method to determine it.

21. What is a T-S diagram ? Draw T-S diagrams for reversible isothermal, reversible adiabatic, reversible isochoric and reversible isobaric.

(1 × 10 = 10 marks)

D 12653 **(Pages : 2)** **Name.....**

Reg. No.....

FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION, NOVEMBER 2021

Physics/Applied Physics

PHY 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

(2021 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. What do you mean by modulus of rigidity ? Give an expression for the work done per unit volume when a body undergoes a strain.
2. Write down the relation connecting Young's modulus, Bulk modulus and rigidity modulus.
3. Draw a diagram to illustrate the terms angle of twist and angle of shear.
4. What are the two forces that govern the shape of a liquid drop ? Why a smaller drop assumes spherical shape ?
5. What do you mean by a viscous force ?
6. What are the basic assumptions used while arriving at the Poiseuille's formula ?
7. What is Brownian motion ?
8. What are the essential conditions for a process to be reversible ?
9. What are the basic processes in a Carnot's cycle ?
10. Give Clausius statement of the second law of thermodynamics.
11. Explain the principle of increase of entropy.
12. Explain the Clausius-Clapeyron equation.

(8 × 3 = 24 marks)

Section B (Paragraph/Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. A bar of width 2.5 cm and thickness 2.5 mm is supported symmetrically on two knife edges kept 1 m apart. When the bar is loaded with weight 200 g at each end, projected 10 cm from the knife edges, the centre is elevated by 4 mm. Estimate the Young's modulus of the material of the bar.

Turn over

14. Water flows through a pipe of radius 0.04 m and length 2 km at the rate of 100 litres/min. If the co-efficient of viscosity of water is 10^{-3} Nsm^{-2} and the atmospheric pressure is 1.01×10^5 Pa, determine the pressure required to maintain the flow.

15. What is the pressure inside a drop of a liquid of radius 3 mm at room temperature, if the surface tension of the liquid at room temperature is 0.465 N/m ?

16. A carnot engine working between 300 K and 600 K has a work output of 800 J per cycle. Determine the amount of heat energy supplied to the engine from the source per cycle.

17. lg of water at 100°C is boiled at a pressure of 1 atm to steam at the same temperature. If the specific latent heat of steam is 226×10^4 J/kg and the specific volume of water and steam at 100°C are 1 cm^3/g and 1671 cm^3/g, determine the work done and increase in internal energy in the process.

18. Prove that the slope of an adiabatic is γ times the slope of the isothermal, where γ is the ratio of the specific heat capacities at constant pressure and constant volume.

19. Discuss the working principle of a Carnot's refrigerator.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*
The question carries 11 *marks.*

20. Obtain an expression for the bending moment of a beam.

21. Explain the term entropy. Obtain an expression for the change of entropy in a reversible isothermal process.

(1 × 11 = 11 marks)

D 93943 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION

NOVEMBER 2020

Physics

PHY 1C 01—PROPERTIES OF MATTER AND THERMODYNAMICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. What do you mean by the term Poisson's ratio ? What are its limiting values ?
2. What do you mean by uniform bending ? How can you achieve uniform bending in a beam ?
3. Compare the couple required for a twist in a hollow and a solid cylinder.
4. What are the two forces that govern the shape of a liquid drop ? Why a larger drop assumes flat shape ?
5. Write down the Newton's law of viscous flow of liquids. Explain the terms involved.
6. What is Brownian motion ?
7. Write down the expression for an isothermal and an adiabatic processes.
8. What do you mean by a quasistatic process ?
9. Explain the first law of thermodynamics.
10. What do you mean by the co-efficient of performance of a refrigerator ?
11. Entropy of an irreversible always increases. Why ?
12. What is the effect of pressure on boiling point of a liquid ? Give an example where it is applicable.

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph/Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. A wire of radius 1 mm is bent to a circle of radius 20 cm. Determine the bending moment. Given, the Young's modulus of the material of the wire is 200 GPa.

14. Calculate the depression at the free end of a light beam loaded by 2 kg at its free end. The length, breadth and depth of the beam are 1.2 m, 3 cm and 9 mm, respectively. Given, the Young's modulus of the material of the beam is 1.9×10^{11} Nm^{-2}.

15. Calculate the work done in twisting a wire through an angle θ assuming the couple per unit twist of the wire as *c*.

16. Determine the energy released when 8 droplets of water of radius 0. 5 mm coalesce to form a single drop. Give, the surface tension of water is 0.072 Nm^{-1}.

17. Prove any statement of the Carnot's theorem.

18. Given, the temperature inside and outside a refrigerator are 273 K 303 K, respectively. Determine the heat delivered to the surroundings for every joule of work done assuming the refrigerator cycle to be reversible.

19. Calculate the change of entropy when 2 kg of water at its boiling point is converted into steam at the same temperature. Given, the specific latent heat of steam is 226×10^4 J/kg.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*
The question carries 11 *marks.*

20. Obtain an expression for the excess pressure inside a liquid drop.

21. Discuss the Carnot's cycle using a neat PV diagram. Obtain an expression for the efficiency.

(1 × 11 = 11 marks)

D 73294 (Pages : 2) Name.....

Reg. No.....

FIRST SEMESTER B.A./B.Sc. DEGREE EXAMINATION NOVEMBER 2019

(CBCSS—UG)

Physics/Applied Physics

PHY 1C 01—PROPERTIES OF MATTER AND THERMO DYNAMICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A (Short Answer Type)

(*Answer* **all** *questions in two* **or** *three sentences. Each correct answer carries a maximum of* 2 *marks*).

1. What do you mean by the term modulus of elasticity ? What are the different types ?
2. Distinguish between uniform and non-uniform bending of beams.
3. Why hollow cylinders are used in shafts ?
4. What do you mean by surface tension ? What is its unit ?
5. Distinguish between streamline and turbulent flows of liquids.
6. Write down the Stokes's formula. What are the terms involved?
7. Distinguish between isochoric and isobaric processes.
8. Explain Carnot's theorem.
9. Give Kelvin's statement of the second law of thermodynamics.
10. Obtain the change of entropy of working substance in a Carnot cycle.
11. What is the effect of pressure on the melting point of a system ? Give an example.
12. Explain the principle of increase of entropy.

(Ceiling 20)

Section B (Paragraph/Problem Type)

(*Answer* **all** *questions in a paragraph of about* **half a page** *to* **one page.** *Each correct answer carries a maximum of* 5 *marks*).

13. Determine the work done in stretching a wire of length 2 m. and cross-section 1 mm^2 through 1 mm. Given, the Young's modulus of the material of the wire is 210 GPa.

Turn over

14. Determine the energy released when 8 droplets of water of radius 0. 5 mm. coalesce to form a single drop. Give, the surface tension of water is 0.072 Nm^{-1}.

15. Estimate the pressure inside a drop of a liquid of radius 2 mm. at room temperature. Given, the surface tension of the liquid at room temperature is 4.65×10^{-1} Nm^{-1}.

16. In a Poiseuille's capillary flow method of determining the co-efficient of water, 50 ml of water is collected in 6 minutes. If the constant pressure used is 0.4 m., length of the capillary tube is 0.8 m. and the diameter of the capillary tube is 1 mm, what will be the viscosity value obtained in the experiment ?

17. Using a suitable figure, explain the working principle of a Carnot's refrigerator.

18. Calculate the change of entropy when 100 g of water is heated from 0°C to 100°C. Given, the specific heat capacity of water is 4200 $JKg^{-1}K^{-1}$.

19. A Carnot engine whose cold reservoir is 300 K has an efficiency of 0.25. How much the temperature of the source be increased to increase the efficiency to 0.75 ?

(Ceiling 30)

Section C (Essay Type)

(Answer in about **two pages***, any* **one** *question. Answer carries* 10 *marks).*

20. Determine the work done per unit volume when a body undergoes (i) Volume strain ; and (ii) shearing strain.

21. Distinguish between isothermal and adiabatic processes. Obtain expressions for the work done in the two processes.

(1 × 10 = 10 marks)