

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

First Semester B.Sc Degree Examination, November 2018

BPHY1B01 – Methodology &amp; Tools of physics

(2017 Admission onwards)

Max. Time: 3 hours

Max. Marks : 80

**PART A****( Answer in a word or phrase)****Answer all questions. Each question carries 1 mark.**

1. Write associative law of vector addition.
2. If  $F$  is a vector  $\nabla \cdot F$  is called-----.
3. A matrix having eigen values + 1 or -1 is called -----
4. A diagonal matrix will have -----.
5. The weight of a body increases if kept in a lift moving -----.
6. Resonance occurs when driving frequency is equal to -----.
7. The result of which experiment led to the discovery of the nucleus?
8. Who discovered LASER?
9. LHC stands for -----.
10. The stability of the Bohr orbits of atom is based on -----.

**(10 x 1 = 10 Marks)****PART B****(Answer in Two or three sentences)****Answer all questions. Each question carries 2 marks.**

11. Which vectors represent the two sides of a paper
12. Check the orthogonality of the matrix  $\frac{1}{9} \begin{pmatrix} -8 & 4 & 1 \\ 1 & 4 & -8 \\ 4 & 7 & 4 \end{pmatrix}$
13. Show that potential energy is a maximum at te extreme points of a SHM.
14. What is ultraviolet catastrophe?
15. How do you define a good model?
16. Explain with an example time dilation in Relativity.
17. Describe the process of scientific writing.

**(7 x 2 = 14 Marks)**

### PART - C

Answer in a paragraph of about half a page to one page)  
Answer any five questions. Each question carries 4 marks

18. Discuss the heat flow equation.
19. State Green's theorem.
20. Define adjoint of a matrix.
21. What are Eigen values and eigenvectors of a matrix?
22. Discuss the behaviour of a two dimensional harmonic oscillator.
23. Distinguish between transverse and longitudinal waves with examples.
24. Give the arguments that lead to the concept of matter waves.
25. What are Pauli spin matrices?

(5 x 4 = 20 Marks)

### PART - D

(Problems-write all relevant formulas. All important steps carry separate marks)  
Answer any four questions. Each question carries 4 marks.

26. Find divergence of the vector  $r = 3xi + y^3j + 3xyzk$
27. If  $r = xi + yj + zk$  find curl of  $r$ .
28. Find the Eigen values and eigen vectors of the matrix  $A = \begin{pmatrix} 3 & -2 \\ -5 & 6 \end{pmatrix}$
29. Write down a symmetric matrix and explain its significance.
30. What will be the kinetic energy of Photoelectrons if light of frequency  $\nu$  is incident on a surface having work function  $\phi$ .
31. A particle executes SHM with  $x = 10 \sin\left(\pi t + \frac{\pi}{2}\right)$ . Find amplitude, frequency and time period of oscillations.
32. A man carrying a load on his head is climbing stairs, descending stairs and walking horizontally. Find expressions for work done in all three cases.

(4 x 4 = 16 Marks)

### PART-E

(Essays - Answer in about two pages)

Answer any two questions. Each question carries 10 marks.

33. Explain Cramer's rule and solve the equations  
 $2x - y + 2z = 2, x + 10y - 3z = 5, -x + y + z = -3.$
34. Briefly describe development of quantum mechanics.
35. Derive an expression for time period of a mass suspended vertically on a spring.
36. State Stokes theorem and Gauss's theorem. Give one application of each.

(2 x 10 = 20 Marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

First Semester B.Sc Degree Examination, November 2018

BPHY1C01 – Properties of matter & thermodynamics

(2017 Admission onwards)

Time: 3 hours

Max. Marks : 64

**PART- A (One word/One Phrase/ True or False)**

**Answer all questions. Each question carries one mark**

- 1 The only elasticity possesses in fluids is -----  
a) Bulk Modulus    b) Young's Modulus    c) Rigidity Modulus    d) None of these
- 2 Dimensions of Young's Modulus are that of -----  
a) F                      b) F/L                      c)  $F/L^2$                       d)  $F/L^3$
- 3 Poisson's ratio cannot have a value -----  
a) 0.7                      b) 0.2                      c) 0.5                      d) none of these
- 4 The forces of attraction act between the molecules of different substances are called -----
- 5 Due to Surface Tension the pressure inside a drop is greater than the pressure outside a drop by an amount of.....  
a)  $3T/r$     b)  $2T/r$     c)  $T/2r$     d)  $T/r$
- 6 When temperature increases viscosity ----- in the case of gases and ----- in the case of liquids.  
a) Increases, decreases                      b) Increases, increases  
c) decreases, decreases                      d) decreases, increases.

**State whether True or False**

- 7 Surface Tension of liquids with impurities is always greater than that of pure solvents or liquids.
- 8 For a stretched wire (Internal energy U function of F, L and T) First law can be written as  $dU =$  -----
- 9 In a reversible adiabatic process, entropy -----  
a) Increases    b) remains unchanged    c) decreases    d) none of these
10. The efficiency of a Carnot's engine working between  $127^\circ\text{C}$  and  $27^\circ\text{C}$  is -----  
a) 25%                      b) 50%                      c) 75%                      d) 100%

(1×10=10 Marks)

**PART-B (Short answer-one or two sentences)**  
**Answer any seven questions. Each carries two marks**

11. Define the term Flexural Rigidity
  12. Why steel is more elastic than rubber?
  13. Why the level of water rises in a capillary tube, while that of mercury is depressed in a capillary tube? Briefly explain.
  14. What is Brownian motion?
  15. What is an isentropic process?
  16. State the Clausius Statement of the second law of Thermodynamics
  17. What is T-S Diagram? What is the importance of T-S Diagram?
- (2×7=14 Marks)

**Part C (Paragraph/Half page)**  
**Answer any three questions, each question carries four marks**

18. Define elastic constants. Establish relations between them.
19. Derive an expression for twisting couple on a cylinder
20. Obtain Stoke's law for the motion of a body in a viscous medium from dimensional considerations.
21. Prove the thermodynamic relation  $(\partial S/\partial V)_T = (\partial P/\partial T)_V$  and  $(\partial S/\partial P)_T = (\partial P/\partial T)_P$ .
22. Define Helmholtz Function and for an isochoric process establish the relation  
$$U = F - T(\partial F/\partial T)_V$$

(4×3=12 Marks)

**Part -D (Problems)**  
**Answer any three questions. Each question carries four marks**

23. Calculate the work done in stretching a uniform metal wire of area of cross section  $10^{-6} \text{ cm}^2$  and length 2.5 m through  $5 \times 10^{-3} \text{ m}$ ? Given  $Y = 2 \times 10^{11} \text{ N/M}^2$ .
24. Calculate the amount of energy needed to break a drop of water diameter  $4 \times 10^{-3} \text{ m}$  into  $10^9$  droplets of equal sizes? Surface Tension of water is  $72 \times 10^{-3} \text{ N/M}$ .
25. Calculate the terminal velocity of an air bubble of radius  $3 \times 10^{-5} \text{ m}$  rising in water of viscosity  $10^{-3} \text{ NS/M}^2$ ? Density of water is  $10^3 \text{ kg/m}^3$ . Neglect density of air in comparison to that of water.
26. Air at NTP is compressed adiabatically to one third of its volume. Calculate the change in its temperature.
27. Calculate the pressure required to make ice freeze at  $-2^\circ\text{C}$  change of specific volume when one gram of water freezes into ice = 0.089 cc?

(4×3=12 Marks)

**PART - E (Essay- within two pages)**  
**Answer any two questions. Each question carries eight marks**

28. Determine the Coefficient of Viscosity using Poiseuille's method.
29. What is a Cantilever? Deduce an expression for the depression produced at its free end when the weight of the beam is negligible.
30. State and Prove Carnot's Theorem.
31. Deduce Maxwell's relations using thermodynamic potentials.

(8×2=16 Marks)