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**First Semester FYUGP Physics Examination**  
**November 2024 (2024 Admission onwards)**  
**KU1DSCPHY111 (PROPERTIES OF MATTER)**  
(EXAM DATE : 06-12-2024)

Time : 90 min

Maximum Marks : 50

**Part A (Answer any 6 questions. Each carries 2 marks)**

1. Define torsional rigidity ? 2
2. Write down the expression for the period of a torsion pendulum. Explain the terms involved. 2
3. State and express equation of continuity of flow. 2
4. Explain Bernoulli's equation and express it in terms of head. 2
5. If  $F = Kv^a r^b \eta^c$ . Find a, b, c through the method of dimensions if F is the force, v the velocity, r the radius and  $\eta$  the coefficient of viscosity. 2
6. What factors influence the terminal velocity of an object in a viscous medium? 2
7. What is surface tension? 2
8. Explain the relationship between the average kinetic energy of gas molecules and the absolute temperature of the gas. 2

**Part B (Answer any 4 questions. Each carries 6 marks)**

9. A hollow shaft is better than a solid shaft. Why? 6
10. A uniform circular disc is suspended by a steel wire and the system is allowed to vibrate torsionally. The periodic time is 4 seconds. Find the period if
  - a. the length of the wire is reduced to one half, and
  - b. two particles having a mass equal to  $\frac{1}{4}$  times the mass of the disc are placed on diametrically opposite points on the circumference of the disc. 6
11. Derive the expression for the critical velocity of a liquid. 6
12. Two equal drops of water are falling through air with a steady terminal velocity of 4cm/s. If the drops coalesce, what will be the new terminal velocity. 6
13. Discuss the molecular forces involved in surface tension and how they lead to the formation of liquid droplets. 6
14. Compare Boyle's, Charles's, and Avogadro's Laws. 6

**Part C (Answer any 1 question(s). Each carries 14 marks)**

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15. (a) Examine the concept of molecular range and its implications for molecular interactions. Analyze how the sphere of influence affects the behavior of molecular systems in different states of matter. 7  
(b) Compare and contrast the surface tension properties of water and mercury. How do molecular forces and the range of interactions contribute to the differences in their surface tension? 7
16. Using Kinetic Theory, derive the expression for pressure exerted by gas molecules. 14