Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **18RO2002** | **Duration :** | **3hrs** |
| **Sub. Name :** | **INTRODUCTION TO MECHANICAL SYSTEMS** | **Max. Marks :** | **100** |

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| **Q. No.** | **Questions** | **Course Outcome** | **Marks** |
| **PART – A (10X1 = 10 MARKS)** | | | |
| 1. | What is the first law of thermodynamics? | CO1 | 1 |
| 2. | What is a real gas? | CO5 | 1 |
| 3. | What is a work transfer? | CO4 | 1 |
| 4. | What is a latent heat ? | CO3 | 1 |
| 5. | Define entropy. | CO6 | 1 |
| 6. | What is a hydrostatic force? | CO1 | 1 |
| 7. | What is a laminar flow? | CO5 | 1 |
| 8. | State Lamis theorem. | CO4 | 1 |
| 9. | Define centroid of the body. | CO3 | 1 |
| 10. | Define the term momentum. | CO6 | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Derive an expression for workdone in an isothermal process. | CO4 | 3 |
| 12. | A piston and cylinder device operates 2 kg of fluid at 10 bar. The initial volume is 0.07 m³. The final volume is 0.02 m³. Calculate the workdone during the process. | CO5 | 3 |
| 13. | A system undergoes a process in which the heat transfer is 60 kilo joule.The work transfer is 110 kilo joule. Calculate the change in internal energy of the system. | CO1 | 3 |
| 14. | A lubricating oil flows in a 12 cm diameter pipe at 8 m/s. The density and dynamic viscosity of the oil are 930 kg/m³ and 0.1 Ns/m². Determine the type of flow. | CO2 | 3 |
| 15. | Distinguish between potential energy and kinetic energy. | CO4 | 3 |
| 16. | The momentum of a body of mass 7 kg is 12 kg m/s. A force of 3 N acts on the body in the direction of motion for 7 s. Find the increase in the kinetic energy. | CO3 | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is a Compulsory Question)** | | | | |
| 17. | a. | Derive an expression for workdone during an polytropic process and draw the p-v diagram. | CO5 | 6 |
| b. | What are the types of equilibrium? Explain. | CO4 | 6 |
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| 18. | a. | Explain the second laws of thermodynamics. | CO2 | 6 |
| b. | Explain the operation of a cyclic heat pump with a block diagram. | CO1 | 6 |
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| 19. | a. | A reverible heat engine operates between two reserviors at temperatures of 1000°C and 300°C. Calculate the maximum efficiency of the heat engine cycle. The heat transfer to the heat engine is 1500 kilo joule. Calculate the work done during the process. | CO6 | 6 |
| b. | A domestic refrigerator operates between -30°C and 30°C Calculate the C.O.P of the refrigerator. Show that the COP of a heat pump is greater than the COP of a refrigerator by unity. | CO5 | 6 |
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| 20. | a. | What is a otto cycle? Explain with a help of a p-v diagram. | CO4 | 6 |
| b. | What is a PMM1? Why is it impossible? What is a thermal energy reservoir? | CO2 | 6 |
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| 21. | a. | A metallic body floats at the interface of mercury and water such that 40% of its volume is submerged in mercury and 60% in water. Estimate the density of the metal. The specific gravity of mercury is 13.6. | CO1 | 6 |
| b. | Derive the continuity equation. What is its significance? | CO3 | 6 |
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| 22. | a. | Determine the flow rate of a fluid passing through a horizontal pipe of 50 mm diameter at inlet and 20 mm diameter at outlet. The velocity of the fluid at inlet is 10 m/s. The density of the fluid is 1.5 kg/m³. | CO6 | 6 |
| b. | Derive an expression for hydrostatic force on a submerged curved surface. | CO2 | 6 |
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| 23. | a. | A body of mass 4 kg travels according to the law x(t) = pt + qt² + rt³ where p = 2 m/s and q = 3 m/s² and r = 4 m/s³. Find the force acting on the body at t = 3 s. | CO5 | 6 |
| b. | The particle of mass 70 kg is at rest. Find the work done to accelerates it by 30 m/s in 20 s. | CO4 | 6 |
| **Compulsory:** | | | |  |
| 24. | a. | A particle moves along the x axis from x = 0 to x = 6 m under the influence of a force given by F = 8 - 3x + 4x².Calculate the workdone in the process. | CO3 | 6 |
| b. | A ball of mass 3 kg and another of mass 5 kg are dropped together from a 20 m tall building. Find their respective kinetic energies ratio, after a fall of 10 m each towards earth. | CO4 | 6 |