Seat No.: _____

Ganpat University

B.Tech Semester III Mechanical/Mechatronics Engineering
Regular Examination Nov/Dec 2011
ME 306 FLUID MECHANICS

Time: 3 Hours Total marks: 70

Instructions:
Show all work clearly and in order.
Attempt all questions in both the sections.
Figure to the right indicate full marks

Section I

Q. 1

Attempt **any one**

(a) i. What are the main types of fluid? Describe each. [6]

ii. A solid cylinder has dia = 4 m. Find the metacentric height of cylinder if specific gravity of cylinder material is 0.6 and it is floating in water with vertical axis. [6]

(b) i. With neat sketch describe the stability concept for submerge bodies. [6]

ii. Find kinematic viscosity of an oil having density 981 kg/m^3. The shear stress at a point in a oil 0.24 N/m^2 and the velocity gradient at that point is 0.2. [6]

Q. 2

Attempt **any one**

(a) i. Differentiate the following: [6]

1. steady flow & unsteady flow
2. compressible & incompressible flow
3. laminar & turbulent flow.

ii. The efficiency η of a fan depends on density ρ, viscosity μ of fluid, angular velocity ω and diameter D of rotor and discharge Q. Express η in terms of dimensionless parameter. [5]

(b) i. The resisting force R depends upon length l, velocity v, viscosity μ, density ρ, and bulk modulus k. Express R in terms of dimensionless parameter. [6]

ii. The diameter of a pipe at inlet and outlet are 10 cm and 15 cm, respectively. Find the discharge through pipe if velocity of water flowing through pipe inlet is 5 m/s. Determine the velocity at outlet. [5]

Q. 3

(a) Explain construction and working of pitot tube and derive the expression for velocity of flowing fluid. [6]

(b) With neat sketch explain consruction and working of venturimeter. [6]

Section II

Q. 4

Attempt **any one**

(a) i. Describe the details of a flow around a blunt body using a neat sketch. [6]

ii. Draw the laminar and turbulent velocity profiles for the same boundary-layer thickness. What information is available from this diagram? [6]

(b) i. What are the three regimes of viscous flow? Explain with neat sketch. [6]

ii. The accepted transition Reynolds number for flow in a circular pipe is $R_{ed}, crit = 2300$. For flow through a 5-cm-diameter pipe, at what velocity will this occur at $20°C$ for (a) airflow and (b) water flow? Assume suitable data. [6]

Q. 5

Attempt **any one**

(a) An ideal gas flows adiabatically through a duct. At section 1, $p_1 = 140kPa$, $T_1 = 260°C$, and $V_1 = 75m/s$. Farther downstream, $p_2 = 30kPa$ and $T_2 = 207°C$. Calculate V_2 in m/s and $s_2 - s_1$ in $J/(kg \cdot K)$ if the gas is (a) air, $\gamma = 1.4$, and (b) argon, $\gamma = 1.67$. [11]

(b) The particle in Fig. 1. is moving supersonically in sea-level standard air. From the two given disturbance spheres, compute the particle Mach number, velocity, and Mach angle. [11]

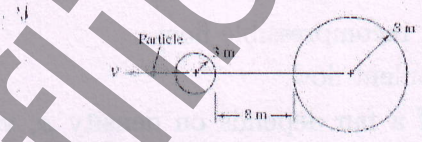

Figure 1

Q. 6

(a) Explain the back pressure variation effect for a convergent-divergent nozzle. [8]

(b) For steady isentropic flow, if the absolute temperature increases 50 percent, by what ratio does the static pressure increase? [4]