Code No: RR212101 **Set No. 1**

II B.Tech I Semester Supplementary Examinations, November 2006
MECHANICS OF FLUID
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) The weight of 8 m^3 of a certain oil is 64 KN. Calculate its specific weight, mass density and specific gravity
   (b) The weight of an object measured on ground level where g = 9.81 m/sec^2 is 35,000 N. Calculate its weight at the following locations (i) Moon gm = 1.62 m/sec^2,(ii) Sun , g_s=274.68 m/sec^2 (iii) Mercury, g_{me} = 3.53 m/ sec^2 (iv) Jupiter, g_j= 26.0 m/sec^2 (v) Saturn, g_{sa} = 11.2 m/sec^2 and (vi) Venus, g_v = 8.54 m/sec^2. Also find the mass density of the object on these planets [8+8]

2. (a) Define and distinguish between steady flow and uniform flow. Give two examples of each flow.
   (b) Derive continuity equation for 1-D flow. [8+8]

3. (a) Derive an expression for the difference of pressure between two points in a free vortex flow.
   (b) An open circular cylinder of 15 cm diameter and 100 cm long contains water up to a height of 70 cm. Find the speed at which the cylinder is to be rotated about its axis so that the axial depth becomes zero. [8+8]

4. (a) What is meant by smooth boundary and a rough boundary?
   (b) Describe briefly the phenomenon of boundary layer separation.
   (c) At what wind speed must a 127 mm diameter sphere travel through water to have a drag of 5 N. [4+6+6]

5. (a) What is the difference between isotropic and adiabatic flow.
   (b) A gas velocity of 300 m/s is flowing through a horizontal pipe at a Section where the pressure is 60 KN/m^2 and temperature 40^0 C. The pipe changes in diameter and at this section pressure is 90 KN/m^2 if the flow of gas is adiabatic find the velocity of gas at this section. [8+8]

6. (a) Derive Hazen-poisehille equation for laminar flow in circular pipes.
   (b) Explain in detail how the flow is demonstrated using Reynold's experiment. [8+8]

7. (a) How will you determine the loss of head due to friction in pipes using Darcy weisbach formula.

(b) An oil pipe line 60cm in diameter and roughness height 0.00005m carries a flow of 0.55 cumecs across the country. The pumping stations are located at every 80km. If the pump efficiency is 85%, determine the power input required at each station when the kinematic viscosity and specific gravity of the oil are $2 \times 10^{-6} m^2$/sec and 0.88 respectively. [8+8]

8. (a) Derive an expression for discharge of liquids through a rectangular notch. Explain how it is modified to take into account the effect of end contractions and velocity of approach.

(b) Explain the working of Viscometers [8+8].

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Code No: RR212101 **Set No. 2**

II B.Tech I Semester Supplementary Examinations, November 2006
MECHANICS OF FLUID
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) The weight of 8 m^3 of a certain oil is 64 KN. Calculate its specific weight, mass density and specific gravity
   (b) The weight of an object measured on ground level where g = 9.81 m/sec^2 is 35,000 N. Calculate its weight at the following locations (i) Moon gm = 1.62 m/sec^2,(ii) Sun , g_s=274.68 m/sec^2 (iii) Mercury, g_{me} = 3.53 m/ sec^2 (iv) Jupiter, g_j= 26.0 m/sec^2 (v) Saturn, g_{sa} = 11.2 m/sec^2 and (vi) Venus, g_v = 8.54 m/sec^2. Also find the mass density of the object on these planets [8+8]

2. (a) Define and distinguish between stream lines, streak lines and path line. When do these three lines coincide?
   (b) For the following velocity vectors, determine the magnitude of the velocity at A(x=2, y=-3,Z =1, t = 2)
      i. V = (10t + xy) i + (- yz ?10t) j + (- yz + z^2/2) k
      ii. V = 4x i + (- 4y + 3t) j [8+8]

3. (a) What is momentum equation? Give applications of the equation.
   (b) Water under a pressure of 345 kN /m^2 is flowing through a 30 cm diameter pipe at the rate of 0.25 m^3 / s. If the pipe is bent by 135^0 to the horizontal, find the magnitude and direction of the resultant force on the bend. Neglect losses. [8+8]

4. (a) Define coefficients of drag and lift and state factors affecting on which those coefficients depend.
   (b) A kite has an effective area of0.4m^2 and weighs 2.0 N in a wind of 40 km/hr., the drag on the kite is 12 N. Determine the tension in chord if the chord make an angle of45^o with the horizontal. Also determine lift coefficient [8+8].

5. (a) What is the difference between isotropic and adiabatic flow.
   (b) A gas velocity of 300 m/s is flowing through a horizontal pipe at a Section where the pressure is 60 KN/m^2 and temperature 40^0 C. The pipe changes in diameter and at this section pressure is 90 KN/m^2 if the flow of gas is adiabatic find the velocity of gas at this section. [8+8]

6. (a) Derive Hazen-poisehille equation for laminar flow in circular pipes.
   (b) Explain in detail how the flow is demonstrated using Reynold's experiment. [8+8]

7. (a)) What is siphon? On what principle it works? Under what conditions would it stop functioning?

   (b) A horizontal pipe of diameter 50cm is suddenly contracted to a diameter of 25cm. The pressure intensities in the large and smaller pipe are given as $13.734 N/cm^2$ and $11.772 N/cm^2$ respectively. If the rate of flow of water is 300lit/sec, find the value of coefficient of contraction [8+8]

8. (a) Derive an expression for discharge of liquids through a rectangular notch. Explain how it is modified to take into account the effect of end contractions and velocity of approach.

   (b) Explain the working of Viscometers [8+8].

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Code No: RR212101 **Set No. 3**

II B.Tech I Semester Supplementary Examinations, November 2006
MECHANICS OF FLUID
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is meant by Newtonian and non-Newtonian fluids. Explain with the help of examples.
   (b) A circular gate in a vertical wall has a diameter of 4m. The water surface on the upstream side is 8m above the top of the gate and on the downstream side 1m above the top of the gate. Find the forces acting on the two sides of the gate and the resultant force acting on the gate and its location. [8+8]

2. (a) What are the methods available for describing the fluid flow? and explain each method.
   (b) A circular pipe 10 cm in diameter has 2 m length which is porous, In this porous section the velocity of exit is known to be constant. If the velocities at the inlet and outlet of the porous section are 2.0 m/sec and 1.2 m/sec respectively, estimate (i) the discharge emitted out through the walls of the porous pipe and (ii) the average velocity of this emitted discharge. [8+8]

3. (a) Derive Bernoulli's equation for flow along a stream line.
   (b) A pipe 200 m long slopes down at 1 in 100 and tapers from 800 mm diameter at the higher end to 400 mm diameter at the lower end and carries 100 lps of oil (S = 0.85). If the pressure gauge reading at the higher end reads 50 kN / m^2, determine, (i) Velocities at the two ends and (ii) pressure at the lower end. Neglect losses [8+8].

4. (a) What is meant by smooth boundary and a rough boundary?
   (b) Describe briefly the phenomenon of boundary layer separation.
   (c) At what wind speed must a 127 mm diameter sphere travel through water to have a drag of 5 N. [4+6+6]

5. (a) Explain the formation of shock waves at various section in a convergent divergent nozzle .
   (b) Calculate the Mach number of an object traveling at 300 m/s in an environment of air at 200 K . Estimate also the corresponding tagnation temperature. [8+8]

6. (a) Sketch the Reynolds apparatus and explain how the laminar flow can be demonstrated with the help of this apparatus.

(b) A viscous liquid was flowing in laminar regime in a 6 cm diameter circular pipe. A pitot tube at a radial distance of 2 cm from the axis indicated a velocity of 0.6 m/sec. Calculate the maximum velocity, the mean velocity and the discharge in the pipe. [8+8]

7. (a) Obtain an expression for the optimum exit diameter of a nozzle to be fitted at the service end of a pipe for maximum power transmission.

   (b) Find the loss of head when a pipe of diameter 20 cm is suddenly enlarged to a diameter of 40cm. The rate of flow of water through the pipe is 250lit/sec.

   [8+8]

8. (a) Derive an expression for discharge of liquids through a rectangular notch. Explain how it is modified to take into account the effect of end contractions and velocity of approach.

   (b) Explain the working of Viscometers [8+8].

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Code No: RR212101 **Set No. 4**

II B.Tech I Semester Supplementary Examinations, November 2006
MECHANICS OF FLUID
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Graphically represent and give one example of Newtonian fluid, pseudoplastic, dilatant, ideal plastic and thyxotropic fluid.
   (b) Through a very narrow gap of height h, a thin plate of very large extent is being pulled at constant velocity V. On one side of the plate is oil of viscosity μ and on the other side oil of viscosity$_{\mu_2}$. Calculate the position of the plate so that the drag force on it will be a minimum. [8+8]

2. (a) State the continuity equation for a three dimensional flow. How is it modified for 2 dimensional and 1 dimensional flows.
   (b) A pipe line 60 cm in diameter bifurcates at a y-junction into two branches of 40 cm and 30 cm diameter. If the ratio of flow in the main pipe $1.2m^3/s$ and the mean velocity of flow in the 30 cm dia. Pipe is 7.5 m/s, determine the rate of flow in the 40 cm pipe. [8+8]

3. (a) What is momentum equation? Give applications of the equation.
   (b) Water under a pressure of 345 kN $/m^2$ is flowing through a 30 cm diameter pipe at the rate of 0.25 m^3 / s. If the pipe is bent by 135^0 to the horizontal, find the magnitude and direction of the resultant force on the bend. Neglect losses. [8+8]

4. (a) What is meant by smooth boundary and a rough boundary?
   (b) Describe briefly the phenomenon of boundary layer separation.
   (c) At what wind speed must a 127 mm diameter sphere travel through water to have a drag of 5 N. [4+6+6]

5. (a) How are shocks formed? Give some practical examples.
   (b) During a normal shock in a constant area duct containing air, the initial conditions are $P_1 = 10N/m^2, T_1 = 0^0c$; U = 1000 m/s Calculate (i) the corresponding trans shock condition and (ii) percentage change in density across the shock if R= 287 J/Kg^0k [8+8]

6. (a) Sketch the Reynolds apparatus and explain how the laminar flow can be demonstrated with the help of this apparatus.
   (b) A viscous liquid was flowing in laminar regime in a 6 cm diameter circular pipe. A pitot tube at a radial distance of 2 cm from the axis indicated a velocity of 0.6 m/sec. Calculate the maximum velocity, the mean velocity and the discharge in the pipe. [8+8]

7. (a) Explain the concept of flow through a long pipe along with a neat sketch.
   (b) A main pipe divides into two parallel pipes which again forms one pipe. The length and diameter for the first parallel pipe are 2000 m and 1.0 m respectively, while the length and diameter of second parallel pipe are 2000 m and 0.8 m. Find the rate of flow in each parallel pipe if total flow in the main is 3.0cumecs. the coefficient of friction for each parallel pipe is same and equal to 0.006. [8+8]

8. (a) What is Manometry. Explain with a neat sketch the working of single column vertical Manometer.
   (b) Explain how you use U-tube manometer to find pressure difference between two points in fluid flow. [8+8]

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