Code No: R05212102 **R05** **Set No. 2**

II B.Tech I Semester Examinations,May/June 2012
MECHANICS OF FLUIDS
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Sketch the Reynolds apparatus and explain how the laminar flow can be demonstrated with the help of this apparatus?
   (b) Oil of absolute viscosity 1.5 poise and relative density 0.85 flows through a 30 cm diameter pipe .If the head losses in a 3000 m length of a pipe is 20 m. Estimate the friction factor by assuming the flow to be laminar. [8+8]

2. (a) A lubricating oil of viscosity μ undergoes steady shear between a fixed lower plate and an upper plate moving at speed V. The clearance between the plates is t. Show that a linear velocity profile results if the fluid does not slip at either plate.
   (b) Describe with a neat sketch a micro-manometer used for very precise measurement of small pressure difference between two points. [8+8]

3. In a 45^0 bend a rectangular air duct of $1m^2$ cross-sectional area is gradually reduced to $0.5m^2$ area. Find the magnitude and direction of the force required to hold the duct in position. If the velocity of flow at the $1m^2$ section is 10m/s, and pressure is 2.943 N/cm^2. Take density of air as 1.16 kg /m^3. [16]

4. (a) Define and explain the terms:
      i. Mach number
      ii. Reynolds Number
      iii. Mach cone
      iv. Mach Angle.
   (b) A projectile is traveling in air having pressure and temperature as 8.829 N/cm^2 and -5^0C. If the mach angle is 30^0, find the velocity of the projectile. Take K=1.4 and R=287 J/Kg-K. [8+8]

5. (a) What are the causes leading to boundary layer separation?
   (b) An aero-plane is flying through air at atmospheric pressure with a velocity of 100 m/sec. Assuming that wings can be treated as flat plates with the boundary layer growing from the leading edge of the wing, calculate the boundary layer thickness at the trailing edge of the wing and the total skin friction dragon the wing. The wing is 2 m long with a width of 15 m. Take for air kinematic viscosity as 1.42 $\times 10^{-5}$ m^2/sec and density as 1.247 kg/m^3. [8+8]

6. (a) Find the velocity and acceleration at a point (1,2,3) after 1 sec. for a three-dimensional flow field given by
u = yz + t, v=xz-t, w=xy, m/s

   (b) State the conditions for a three-dimensional flow to be irrotational. [10+6]

7. (a) Explain the concentric cylinder viscometer in detail with diagram and also derive the expression to find the value of viscosity of a given fluid.

   (b) Water flows in 300 mm pipe. Two pitot tubes are installed in the pipe, one on the centerline and other 75 mm from the centerline. If the velocities at the two points are 3 m/sec and 2 m/sec respectively. Calculate the reading on the differential mercury manometer connected to the two tubes. [7+9]

8. (a) For sudden expansion in pipe flow, what is the optimum ratio between the diameter of the pipe before expansion and diameter pipe after expansion so that the pressure rise may be maximum.

   (b) Oil of specific gravity 0.5 flows in a 8 cm diameter pipeline. A sudden expansion takes place into a second pipeline of such diameter that the maximum pressure rise is obtained. If the rate of flow through the pipeline is 12.5 l/sec, find the loss of energy in sudden expansion in centimetres of oil. [10+6]

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Code No: R05212102 **R05** **Set No. 4**

II B.Tech I Semester Examinations,May/June 2012
MECHANICS OF FLUIDS
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) A lubricating oil of viscosity μ undergoes steady shear between a fixed lower plate and an upper plate moving at speed V. The clearance between the plates is t. Show that a linear velocity profile results if the fluid does not slip at either plate.
   (b) Describe with a neat sketch a micro-manometer used for very precise measurement of small pressure difference between two points. [8+8]

2. (a) Explain the concentric cylinder viscometer in detail with diagram and also derive the expression to find the value of viscosity of a given fluid.
   (b) Water flows in 300 mm pipe. Two pitot tubes are installed in the pipe, one on the centerline and other 75 mm from the centerline. If the velocities at the two points are 3 m/sec and 2 m/sec respectively. Calculate the reading on the differential mercury manometer connected to the two tubes. [7+9]

3. (a) What are the causes leading to boundary layer separation?
   (b) An aero-plane is flying through air at atmospheric pressure with a velocity of 100 m/sec. Assuming that wings can be treated as flat plates with the boundary layer growing from the leading edge of the wing, calculate the boundary layer thickness at the trailing edge of the wing and the total skin friction dragon the wing. The wing is 2 m long with a width of 15 m. Take for air kinematic viscosity as 1.42 $\times 10^{-5}$ m^2/sec and density as 1.247 kg/m^3. [8+8]

4. (a) Find the velocity and acceleration at a point (1,2,3) after 1 sec. for a three-dimensional flow field given by
   u = yz + t, v=xz-t, w=xy, m/s
   (b) State the conditions for a three-dimensional flow to be irrotational. [10+6]

5. (a) Define and explain the terms:
      i. Mach number
      ii. Reynolds Number
      iii. Mach cone
      iv. Mach Angle.
   (b) A projectile is traveling in air having pressure and temperature as 8.829 N/cm^2 and -5^{0}C. If the mach angle is 30^0, find the velocity of the projectile. Take K=1.4 and R=287 J/Kg-K. [8+8]

6. In a 45^0 bend a rectangular air duct of $1m^2$ cross-sectional area is gradually reduced to $0.5m^2$ area. Find the magnitude and direction of the force required to hold the duct in position. If the velocity of flow at the $1m^2$ section is 10m/s, and pressure is 2.943 N/cm^2. Take density of air as 1.16 kg /m^3. [16]

7. (a) For sudden expansion in pipe flow, what is the optimum ratio between the diameter of the pipe before expansion and diameter pipe after expansion so that the pressure rise may be maximum.

   (b) Oil of specific gravity 0.5 flows in a 8 cm diameter pipeline. A sudden expansion takes place into a second pipeline of such diameter that the maximum pressure rise is obtained. If the rate of flow through the pipeline is 12.5 l/sec, find the loss of energy in sudden expansion in centimetres of oil. [10+6]

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

   (b) Oil of absolute viscosity 1.5 poise and relative density 0.85 flows through a 30 cm diameter pipe. If the head losses in a 3000 m length of a pipe is 20 m. Estimate the friction factor by assuming the flow to be laminar. [8+8]

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Code No: R05212102 **R05** **Set No. 1**

II B.Tech I Semester Examinations,May/June 2012
MECHANICS OF FLUIDS
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Find the velocity and acceleration at a point (1,2,3) after 1 sec. for a three-dimensional flow field given by
   u = yz + t, v=xz-t, w=xy, m/s
   (b) State the conditions for a three-dimensional flow to be irrotational. [10+6]

2. (a) Define and explain the terms:
      i. Mach number
      ii. Reynolds Number
      iii. Mach cone
      iv. Mach Angle.
   (b) A projectile is traveling in air having pressure and temperature as 8.829 N/cm^2 and -5^{0}C. If the mach angle is 30^0, find the velocity of the projectile. Take K=1.4 and R=287 J/Kg-K. [8+8]

3. (a) Explain the concentric cylinder viscometer in detail with diagram and also derive the expression to find the value of viscosity of a given fluid.
   (b) Water flows in 300 mm pipe. Two pitot tubes are installed in the pipe, one on the centerline and other 75 mm from the centerline. If the velocities at the two points are 3 m/sec and 2m/sec respectively. Calculate the reading on the differential mercury manometer connected to the two tubes. [7+9]

4. (a) Sketch the Reynolds apparatus and explain how the laminar flow can be demonstrated with the help of this apparatus?
   (b) Oil of absolute viscosity 1.5 poise and relative density 0.85 flows through a 30 cm diameter pipe. If the head losses in a 3000 m length of a pipe is 20 m. Estimate the friction factor by assuming the flow to be laminar. [8+8]

5. In a 45^0 bend a rectangular air duct of 1m^2 cross-sectional area is gradually reduced to 0.5m^2 area. Find the magnitude and direction of the force required to hold the duct in position. If the velocity of flow at the 1m^2 section is 10m/s, and pressure is 2.943 N/cm^2. Take density of air as 1.16 kg /m^3. [16]

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friction dragon the wing. The wing is 2 m long with a width of 15 m. Take for air kinematic viscosity as 1.42 $\times 10^{-5}$ m^2/sec and density as 1.247 kg/m^3. [8+8]

7. (a) For sudden expansion in pipe flow, what is the optimum ratio between the diameter of the pipe before expansion and diameter pipe after expansion so that the pressure rise may be maximum.

   (b) Oil of specific gravity 0.5 flows in a 8 cm diameter pipeline. A sudden expansion takes place into a second pipeline of such diameter that the maximum pressure rise is obtained. If the rate of flow through the pipeline is 12.5 l/sec, find the loss of energy in sudden expansion in centimetres of oil. [10+6]

8. (a) A lubricating oil of viscosity μ undergoes steady shear between a fixed lower plate and an upper plate moving at speed V. The clearance between the plates is t. Show that a linear velocity profile results if the fluid does not slip at either plate.

   (b) Describe with a neat sketch a micro-manometer used for very precise measurement of small pressure difference between two points. [8+8]

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Code No: R05212102 **R05** **Set No. 3**

II B.Tech I Semester Examinations,May/June 2012
MECHANICS OF FLUIDS
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) For sudden expansion in pipe flow, what is the optimum ratio between the diameter of the pipe before expansion and diameter pipe after expansion so that the pressure rise may be maximum.
   (b) Oil of specific gravity 0.5 flows in a 8 cm diameter pipeline. A sudden expansion takes place into a second pipeline of such diameter that the maximum pressure rise is obtained. If the rate of flow through the pipeline is 12.5 l/sec, find the loss of energy in sudden expansion in centimetres of oil. [10+6]

2. (a) Explain the concentric cylinder viscometer in detail with diagram and also derive the expression to find the value of viscosity of a given fluid.
   (b) Water flows in 300 mm pipe. Two pitot tubes are installed in the pipe, one on the centerline and other 75 mm from the centerline. If the velocities at the two points are 3 m/sec and 2 m/sec respectively. Calculate the reading on the differential mercury manometer connected to the two tubes. [7+9]

3. (a) Sketch the Reynolds apparatus and explain how the laminar flow can be demonstrated with the help of this apparatus?
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4. (a) A lubricating oil of viscosity μ undergoes steady shear between a fixed lower plate and an upper plate moving at speed V. The clearance between the plates is t. Show that a linear velocity profile results if the fluid does not slip at either plate.
   (b) Describe with a neat sketch a micro-manometer used for very precise measurement of small pressure difference between two points. [8+8]

5. (a) Define and explain the terms:
      i. Mach number
      ii. Reynolds Number
      iii. Mach cone
      iv. Mach Angle.
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u = yz + t, v=xz-t, w=xy, m/s
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   (b) An aero-plane is flying through air at atmospheric pressure with a velocity of 100 m/sec. Assuming that wings can be treated as flat plates with the boundary layer growing from the leading edge of the wing, calculate the boundary layer thickness at the trailing edge of the wing and the total skin friction dragon the wing. The wing is 2 m long with a width of 15 m. Take for air kinematic viscosity as 1.42 $\times 10^{-5}$ m^2/sec and density as 1.247 kg/m^3. [8+8]

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