

Code No: R05212102

R05**Set No. 2**

II B.Tech I Semester Examinations, November 2010

MECHANICS OF FLUIDS

Aeronautical Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

1. (a) What sonic velocity? On what factors does it depend?
 (b) A gas of 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°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 the gas at this section. [8+8]
2. (a) Derive Darcy-Weisbach equation for loss of head in a pipe.
 (b) Two tanks are connected by a 300 mm diameter 1000 m long pipe. Find the rate of flow if the difference of water level in the tank is 10 m. Take $4f = 0.04$ and ignore minor losses. [10+6]
3. A venturimeter having inlet diameter 100 mm and throat diameter 25mm is fitted in a vertical pipe, throat is 0.3 m below inlet for measuring the flow of petrol of specific gravity 0.78. Pressure gages are fitted at inlet and throat. Assuming the loss of head between inlet and throat 30 times the velocity head at inlet. Find
 (a) C_d for the meter.
 (b) The discharge in lit/minute when the inlet gauge reads 274.78 kn/m^2 more than the throat gauge. [16]
4. (a) A plate 0.05 mm distant from a fixed plate moves at 1.2 m/s and requires a force of 2.2 N/m^2 to maintain this speed. Find the viscosity of the fluid between the plates.
 (b) Explain how vacuum pressure can be measure with the help of a U-tube manometer. [8+8]
5. (a) How are the drag and lift forces caused on a body immersed in a moving fluid?
 (b) A flat plate $1.2 \text{ m} \times 1.2 \text{ m}$ moves at 60 km per hour in a stationary air of density 1.15 kg/m^3 . If the coefficient of drag and lift are 0.15 and 0.75 respectively, determine [6+10]
 i. The drag force
 ii. The lift force
 iii. The resultant force and
 iv. The power required to keep the plate in motion.
6. (a) If the expression for stream function is described by $= x^3 - 3xy^2$ determine whether flow is rotational or irrotational. If the flow is irrotational, then indicate the value of the velocity potential.

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i. $\phi = y^3 - 3x^2y$

ii. $\phi = -3x^2y$

(b) If stream function exists for a flow does it imply that velocity potential also exists? [10+6]

7. (a) What do you meant by viscous flow? Mention various forces to be considered in Navier Stroke's equation.

(b) Through a horizontal circular pipe of diameter 100 mm and of length 10m, an oil of dynamic 0.097 poise and relative density 0.9 is flowing. Calculate the difference of pressure at the two ends of the pipe, if 100 Kg. of the oil is collected in a tank in 30 seconds. [10+6]

8. An open circuit wind tunnel draws air from the atmosphere through a well contoured nozzle. In the test section, where the flow is straight and nearly uniform, a static pressure tap is drilled into the tunnel wall. A manometer connected to the tap shows that the wall pressure within the tunnel is 45 mm of water below atmospheric. Assume that air is incompressible and at 25⁰ C, pressure is 100 Kpa(absolute). Calculate the velocity in the wind tunnel section. Density of water is 999kg/m³ and characteristic gas constant for air is 287 J/Kg K. [16]

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1. (a) If the expression for stream function is described by $\psi = x^3 - 3xy^2$ determine whether flow is rotational or irrotational. If the flow is irrotational, then indicate the value of the velocity potential.
 - i. $\phi = y^3 - 3x^2y$
 - ii. $\phi = -3x^2y$
- (b) If stream function exists for a flow does it imply that velocity potential also exists? [10+6]
2. (a) How are the drag and lift forces caused on a body immersed in a moving fluid?
- (b) A flat plate $1.2 \text{ m} \times 1.2 \text{ m}$ moves at 60 km per hour in a stationary air of density 1.15 kg/m^3 . If the coefficient of drag and lift are 0.15 and 0.75 respectively, determine [6+10]
 - i. The drag force
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3. (a) What do you mean by viscous flow? Mention various forces to be considered in Navier Stroke's equation.
- (b) Through a horizontal circular pipe of diameter 100 mm and of length 10 m , an oil of dynamic 0.097 poise and relative density 0.9 is flowing. Calculate the difference of pressure at the two ends of the pipe, if 100 Kg. of the oil is collected in a tank in 30 seconds . [10+6]
4. (a) What sonic velocity? On what factors does it depend?
- (b) A gas of 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°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 the gas at this section. [8+8]
5. A venturimeter having inlet diameter 100 mm and throat diameter 25 mm is fitted in a vertical pipe, throat is 0.3 m below inlet for measuring the flow of petrol of specific gravity 0.78 . Pressure gages are fitted at inlet and throat. Assuming the loss of head between inlet and throat 30 times the velocity head at inlet. Find
 - (a) C_d for the meter,

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- (b) The discharge in lit/minute when the inlet gauge reads 274.78 kn/m^2 more than the throat gauge. [16]
6. (a) A plate 0.05 mm distant from a fixed plate moves at 1.2 m/s and requires a force of 2.2 N/m^2 to maintain this speed. Find the viscosity of the fluid between the plates.
- (b) Explain how vacuum pressure can be measure with the help of a U-tube manometer. [8+8]
7. (a) Derive Darcy-Weisbach equation for loss of head in a pipe.
- (b) Two tanks are connected by a 300 mm diameter 1000 m long pipe. Find the rate of flow if the difference of water level in the tank is 10 m. Take $4f = 0.04$ and ignore minor losses. [10+6]
8. An open circuit wind tunnel draws air from the atmosphere through a well contoured nozzle. In the test section, where the flow is straight and nearly uniform, a static pressure tap is drilled into the tunnel wall. A manometer connected to the tap shows that the wall pressure within the tunnel is 45 mm of water below atmospheric. Assume that air is incompressible and at 25°C , pressure is 100 Kpa(absolute). Calculate the velocity in the wind tunnel section. Density of water is 999 kg/m^3 and characteristic gas constant for air is 287 J/Kg K . [16]

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R05**Set No. 1**

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4. (a) What sonic velocity? On what factors does it depend?
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5. (a) What do you mean by viscous flow? Mention various forces to be considered in Navier Stroke's equation.
 (b) Through a horizontal circular pipe of diameter 100 mm and of length 10m, an oil of dynamic 0.097 poise and relative density 0.9 is flowing. Calculate the difference of pressure at the two ends of the pipe, if 100 Kg. of the oil is collected in a tank in 30 seconds. [10+6]
6. A venturimeter having inlet diameter 100 mm and throat diameter 25mm is fitted in a vertical pipe, throat is 0.3 m below inlet for measuring the flow of petrol of

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specific gravity 0.78. Pressure gages are fitted at inlet and throat. Assuming the loss of head between inlet and throat 30 times the velocity head at inlet. Find

- (a) C_d for the meter,
 - (b) The discharge in lit/minute when the inlet gauge reads $274.78 \text{ kn}/m^2$ more than the throat gauge. [16]
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- i. $\phi = y^3 - 3x^2y$
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- (b) If stream function exists for a flow does it imply that velocity potential also exists? [10+6]
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- (b) A gas of 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°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 the gas at this section. [8+8]
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