Question Paper

Exam Date & Time: 18-Nov-2019 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
END SEMESTER THEORY EXAMINATIONS
NOVEMBER2019
III SEMESTER B.sc. (Applied Sciences) in Engg.
FLUID MECHANICS [ICE 232]

Marks: 100 **Duration: 180 mins.**

Answer 5 out of 8 questions.
Missing data, if any, may be suitably assumed.

1)		Define: a) Capillarity b) Surface Tension c) Relative density d) Compressibility.	(6)
	A)		
	B)	The space between two square flat parallel plates is filled with oil. Each side of the plate is 60cm. The thickness of the oil film is 12.5mm. The upper plate which moves at 2.5 m/s requires a force of 98.1 N to maintain the speed. Determine, The dynamic viscosity of the oil in poiseThe kinematic viscosity of the oil in stokes if the specific gravity is 0.95.	(6)
	C)	A U-tube manometer is used to measure the oil pressure of specific gravity 0.85 flowing in a pipe line. Its left end is connected to the pipe and the right limb is open to the atmosphere. The centre of the pipe is 100mm below the level of mercury in the right limb (specific gravity 13.6). If the difference in the mercury levels in the two limbs is 160mm, determine the absolute pressure of the oil in the pipe. Draw a neat sketch.	(8)
2)		Define: a) Absolute Zero Pressure b) Local Atmospheric Pressure c) Pressure Head d) Standard atmospheric pressure	(6)
	A)		
	B)	A closed tank contains water to a depth of 2m, oil (specific gravity of 0.8) over it to a depth of 1m and air at the top to a depth of 0.7m. If the vacuum gauge at the top of tank reads 7.6 cm of mercury (-ve pressure). a) Find the pressure at the bottom of the tank. b) Express the pressures in kPa, in gauge and absolute units.	(6)
	C)	Find the resultant water pressure on a radial gate of 90° sector of 4m radius. Take the width of the gate as unity. The top of the gate is with the free water surface.	(8)
3)		Write a short note on pressure distribution diagram and its application.	(6)
	A)		
	B)		(6)

Derive an expression for the velocity distribution in a steady laminar flow in pipes.

C) A horizontal venturimeter with inlet diameter 20cm and throat diameter 10cm is used to measure the flow of water. The pressure at the inlet is 17.658 N/cm^2 and the vacuum pressure at the throat is 30 cm of mercury. Find the discharge of water through the venturimeter in lps. Take Cd = 0.98. (8)

4) Define: s) Steady flow b) Turbulent flow c) Incompressible flow d) Sub-critical flow. (6)

A)

B) Water is supplied to the inhabitants of a college campus through a supply main. The following data is given. (6)
Distance of the reservoir from the campus = 3000 m
Number of inhabitants = 4000
Consumption of water per day of each inhabitant = 180 liters
Loss of head due to friction = 18 m
Friction factor for the pipe = 0.028
If the half of the demand is supplied in 8 hours, determine the size of the supply main.

C) Water flows through a pipe AB of 1.2 m diameter at 3 m/s and then passes through a pipe BC of 1.5m diameter. At C it branches into CD and CE. The branch CD is 0.8 m in diameter and carries one-third of the flow in AB. The velocity in the branch CE is 2.5 m/s. Find the rate of flow in AB, velocity in BC and CD and the diameter of CE. (8)

5) With a neat sketch explain the 'Bourdon Tube Pressure Gauge'. (6)

A)

B) The following data refer to an orificemeter: (6)
Diameter of the pipe = 240mm; Diameter of the orifice = 120mm; Specific gravity of the oil = 0.88; Reading of the differential manometer = 400mm of mercury; Coefficient of discharge of the orifice meter = 0.65.
Determine the rate of flow of the oil.

C) An oil of viscosity 0.15 Ns/m^2 and specific gravity of 0.9 is flowing through a circular pipe of diameter 30 mm and length 3m. The velocity of flow is 1/10th the velocity for a Reynold's number of 2450. Find, (8)
a) The velocity of flow through the pipe
b)The head in meters of oil required to maintain this flow
c) Power required

6) Explain with near sketches: a) External Mouthpiece b) Convergent divergent mouthpiece. Why mouthpieces are better than the orifices? (6)

A)

B) If $v = -3z^2y-2y^2$ and $w = -4xz+2yz$, determine the value of u so that continuity equation is satisfied. (6)

C) A trapezoidal section of best hydraulic properties carries a discharge of 15 cumec at a velocity of 1m/s. The sides slope is 2H:1V. Determine the bed width, depth of flow and the longitudinal slope required for the above condition. Take Manning's n =0.02 (8)

7) Write short note on Cippoletti notch. How it differs from rectangular/trapezoidal notch? (4)

A)

B) An external cylindrical mouthpiece of diameter 120mm is discharging water under a constant head of 6m. If Cc for vena-contracta = 0.62, *Cd=0.86* and atmospheric pressure head = 10.3 m of water, find; (8)
a) Discharge through the mouthpiece
b)Absolute pressure head of water at vena-contracta. Draw a neat sketch.

C) A syphon of diameter 200mm connects 2 reservoirs having a difference in elevation of 15m. The total length of the syphon is 600m and the summit is 4m above the water level in the upper reservoir. If the separation takes place at 2.8m of water absolute, find the maximum length of the syphon from upper reservoir to summit. Take f=0.016 and atmospheric pressure as 10.3m of water. (8)

8) Explain the types of hydraulic jump with neat sketches. (6)

A)

B) A trapezoidal channel has sides of 3 horizontals to 4 verticals. The bed slope is 1 in 2000. Determine the optimum dimensions of the channel if it is to carry water at 0.5 m^3/s. Take Chezy's constant as 80. (6)

C) A pipe of diameter 20cm and length 2000m connects two reservoirs having difference of water level of 20m. Determine the discharge through the pipe. If additional pipe of diameter 20cm and length 1200m is attached to the last portion of 1200m of the existing portion, find the increase in discharge. (8)

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