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Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF MECHANICAL ENGINEERING

CONTINUOUS ASSESSMENT TEST – II

WINTER SEMESTER 2022-2023

Program Name & Branch: B. Tech (Mechanical Engineering)
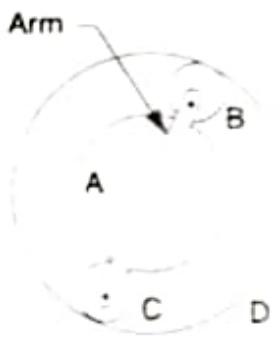
Course Code: BMEE207L

Course Name: Kinematics and Dynamics of Machines

Faculty Name(s): Deepa A, Niranjana Behera, Senthilnathan.N, Sridharan.K & Venkatesan.S

Class Number(s): VL2022230501012, VL2022230500994, VL2022230500998, VL2022230501010, VL2022230501014

Exam Duration: 90 minutes   **Maximum Marks: 50**

Q.No	Question	Marks
1.	Design a cam of an oil engine to raise a valve by 50 mm through 120° of the cam revolution. During the raise of the valve, the follower follows S.H.M motion during the first 60° and Uniform acceleration and deceleration during the next 60°. The diameter of the roller is 20mm and minimum radius of the cam is 25mm.	10
2.	Synthesize a four-bar mechanism is used to transfer electricity to the main transformer of the electric locomotives. Assume suitable data.	10
3.	Design 20° involute gears to avoid interference of module 4mm and addendum 1.23 module in such a way that when they mesh with each other the velocity ratio is 2.5. The pinion gear rotates at 150 rpm.	10
4.	In an epi-cyclic gear train as shown in the figure, the number of teeth on gears A and D is 42 and 82. When Gear A makes one revolution clockwise and D makes half revolution counterclockwise, determine the number of revolutions made by the arm which holds both the pinion gears.	10
5.	A vertical petrol engine of 100mm diameter and 120mm stroke has a connecting rod of 250 mm long. The mass of the piston is 1.1 kg, the speed is 2000 rpm on the expansion stroke with a crank 20° from top dead centre, the gas pressure is 700 kN/m². Determine various forces acting on piston and guided pin end with a FBD	10

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SCHOOL OF MECHANICAL ENGINEERING

CONTINUOUS ASSESSMENT TEST – II

WINTERSEMESTER 2022-2023

Programme Name & Branch: B.Tech- Automotive, Mechanical, Manufacturing Engineering
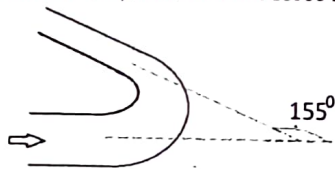
Course Code& Name:BMEE204 and Fluid Mechanics and Machines

Faculty Name(s): Dr. Anuj Kumar, Dr. Immanuel Selwyn Raj A, Dr.Sekarapandian N, Dr. Sreeja Sadasivan,

Class Number(s):VL2022230501045, VL2022230501046, VL2022230501047, VL2022230501049

Exam Duration:90 minutes

Maximum Marks:5 x 10=50M

Q.No	Question
1.	Two venturimeter of different area ratio are connected at different locations at the same pipe and similar manometers are used to measure pressure heads. The second venturimeter of area ratio 5 registers a pressure head 6h and the first one registers 1.5h. Find the area ratio of the first venturimeter. Assume that the C_d value is same for both the venturimetrs.
2.	The viscous fluid flows in 12 cm pipe such that its velocity measured 2 cm away from the pipe wall is 0.98 m/s. Consider the flow is laminar and determine: a) centre line velocity b) maximum shear stress c) flow rate d) pressure head for a pipe length of 350 mm Also, draw the shear stress and velocity profile
3.	An oil of density 900 kg/m³ flowing through an elbow makes a 155° turn before being discharged, as shown in Fig.2. The elevation difference between the centers of inlet and the exit sections is 0.4 m and the inlet velocity is 7 m/s. If the pipe diameter at the entrance and exit are 350 mm and 100 mm, a) Determine the gage pressure at the pipe entrance, assuming the pressure at the exit is atmospheric. b) Neglecting the weight of fluid and elbow, find the total force needed to hold the pipe in place. 155⁰ Fig.1

| 4. | The air flow rate in a pipe at 18°C is 11 m³/min. A thick filter is being tested for losses. The upstream pressure is measured as 130 kPa. Find the loss coefficient K_L of the filter by using the water manometer reading?
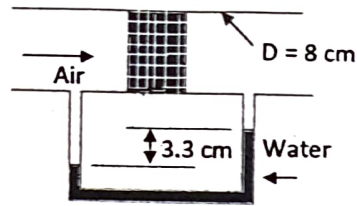

Fig. 2 |
|---|---|
| 5. | The wall shear stress τ_w for flow in a narrow annular gap between a fixed and a rotating cylinder is a function of density ρ, viscosity μ, angular velocity Ω, outer radius R, and gap width Δr. Using Buckingham's method, determine the functional relationship for the dependent wall shear stress τ_w. |

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SCHOOL OF MECHANICAL ENGINEERING

CONTINUOUS ASSESSMENT TEST – II

WINTER SEMESTER 2022-2023 (Seniors)

Programme Name & Branch: B.Tech- Automotive, Mechanical, Manufacturing Engineering

|	
Course Code	: BMEE204L
Course Name	: Fluid Mechanics and Machines
Class Number(s)	: VL2022230500741, VL2022230501042, VL2022230501040
	VL2022230501043, VL2022230500747
Faculty Members	: Dr. Mohamed Ibrahim M, Dr. Deepakkumar R, Dr. Abinash Mohanta, Dr. Aruna Kumar Behura Dr. Praveen Kumar G

Exam Duration: 90 minutes

Maximum Marks: 5

General instruction(s):

(i) Assume if any values are need with proper justifications

Q.No	Question	Marks
1.	In the R-block hostel, a vertical venturimeter is fixed to measure the flowrate of water to the overhead tank. The vertical venturimeter has an inlet and throat diameter of 200 mm and 75 mm, respectively. The pressure connection at the throat is 150 mm above that at the inlet. The pressure loss is 0.5 m between inlet to throat. If the actual rate of flow is 50 litres/s and the coefficient of discharge is 0.96, calculate (i) the pressure difference between inlet and throat in N/m^2, and Calculate the difference of pressure between main and throat in meters if it is measured by two different U-tube manometers ii) mercury manometer iii) manometer with fluid specific gravity of 3.	10
2	The library block's air conditioning system receives chilled water from the SJT Annexe using the circular pipe of 0.3 m^3/s of water carrying capacity. At front of the library block, in the horizontal position the pipe of 200 mm diameter is decreased to 150 mm diameter with bend angle of 120°. The pressure at inlet to the bend is 300 kPa	10

Determine the magnitude and direction of the force exerted by the bend, if 10% of the exit kinetic energy is lost in the bend.

Library Block
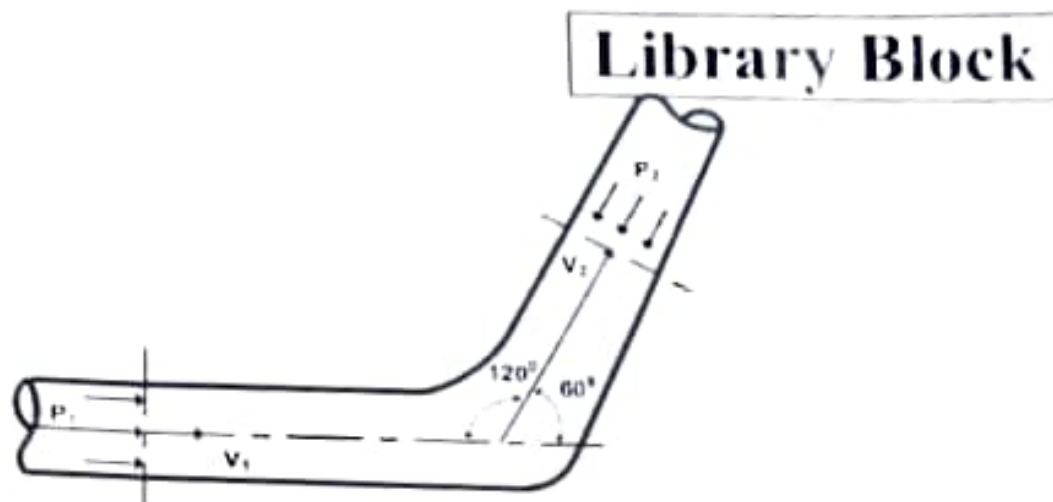
3

In the shuttle bus, SAE 10 oil is used for engine cooling system. The oil viscosity 0.02 poise and specific gravity 0.8 is flowing through 50 mm diameter pipe and length 500 m at the rate of 0.19 lit./sec. Determine:

    (i) Centre-line velocity,
    (ii) Pressure gradient,
    (iii) Wall shear stress,
    (iv) Power required to maintain the flow and
    (v) Comment on the fluid flow regime.

10

4

In the Anna auditorium, the cooling air from the air-conditioning system enters the auditorium through a rectangular duct. Air (ρ = 1.2 kg/m^3 and γ = 1.5 X 10^{-5} m^2/s) flows at a rate of 2.5 m^3/s in a 30 cm X 60 cm steel rectangular duct (roughness value for steel, k = 4.6 X 10^{-5} m). What is the pressure drop i) front of the hall at 10 m of the duct and ii) the rear end of the hall at 50 m of the duct? Use Moody's chart.

10

5

The wall shear stress τ_w in a boundary layer is assumed to be a function of stream velocity U, boundary layer thickness δ, local turbulence velocity u', density ρ, and local pressure gradient dp/dx. Write the dimensionless parameters.

10