Question Paper

Exam Date & Time: 11-May-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, APRIL - MAY 2024

INDUSTRIAL INSTRUMENTATION [ICE 2223]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1)		Using graphical analysis, illustrate the temperature variation of different materials in RTD.**(CO1, BL3, PO1, 2,3)**	(3)
	A)		
	B)	With suitable depiction of schematics, illustrate the underlying principle and working mechanism of Coriolis mass flowmeter. Would you recommend employing Coriolis flowmeter in an industrial set-up which lies close to roads with regular heavy vehicle transportation? Justify your answer. **(CO3, BL4, PO1, 2, 3, 4)**	(5)
	C)	A Venturi tube of throat diameter 5 cm has a discharge coefficient of 0.98. With a flow rate of 10 dm^3/s, the pressure differential is 12.5 KPa. Determine the flow rate when an orifice of 5 cm with discharge coefficient 0.6 is used in the same pipe, maintaining the same pressure differential. **(CO3, BL3, PO1, 2, 3)**	(2)
2)		With neat sketch, elucidate the working principle of mechanical tachometer and its limitations. **(CO4, BL3, PO1, 2, 3)**	(4)
	A)		
	B)	Mathematically determine the limiting conditions for use of a U tube manometer of length 76 cm and area of cross section 6 $cm^2$for measurement of differential pressure across a venturi flowmeter. Arrive at expressions relating the measurement of level, pressure and hence flow in this particular case. **(CO2, BL3, PO1,2, 3, 4)**	(4)
	C)	Illustrate briefly the use of bourdon tubes in measurement of fluid pressure in an industrial boiler. **(CO2, BL3, PO1,2, 3, 4)**	(2)
3)		Differentiate the different varieties of orifice plates used in industries and provide suitable reasoning for their use in measuring specific process fluids.	(3)
	A)	**(CO3, BL3, PO1, 2, 3,4)**	
	B)	With the help of suitable diagrams and expressions, illustrate the use of Mcleod gauge in measurement of vacuum. **(CO2, BL3, PO1, 2, 3,4)**	(4)
	C)	With the help of mathematical expressions, illustrate the capacitive transduction mechanism of differential pressure. **(CO2, BL3, PO1, 2, 3,4)**	(3)
4)		Interpret the importance of gas void fraction in selection of multi-phase flowmeters. Derive the flow model with respect to orifice meter used for momentum flux measurement in oil & gas industry. **(CO3, BL3, PO1,2,3,4)**	(5)
	A)		

B) How can the sag of a tied string be used to measure dive in submarines? Illustrate with suitable mathematical expressions. **(CO4, BL3, PO1,2, 3, 4)** (3)

C) While measuring speed of a steam turbine with stroboscope single line images were observed for stroboscope setting of 3000,4000 and 5230 rpm. Calculate the speed of the turbine. **(CO4, BL3, PO1,2, 3, 4)** (2)

5) A) Arrive at an expression for measurement of level of carbon fines in a cylo using (a) Differential pressure transducer and (b) load cell. What are the pertinent assumptions that you have made to arrive at these expressions? **(CO4, BL3, PO1,2, 3, 4)** (4)

B) A transit time ultrasonic flowmeter uses a pair of ultrasonic transducers placed at 45^0 angle, as shown in Figure 5B. The inner diameter of pipe is 0.5 meter. The differential transit time is directly measured using a clock of frequency 5 MHz. Taking velocity of sound in the fluid as 1500 m/s, analyze flow rate expression for the meter and determine the minimum change in fluid velocity (m/s) that can be measured using this system. (4)

(CO3, BL4, PO1,2, 3, 4)

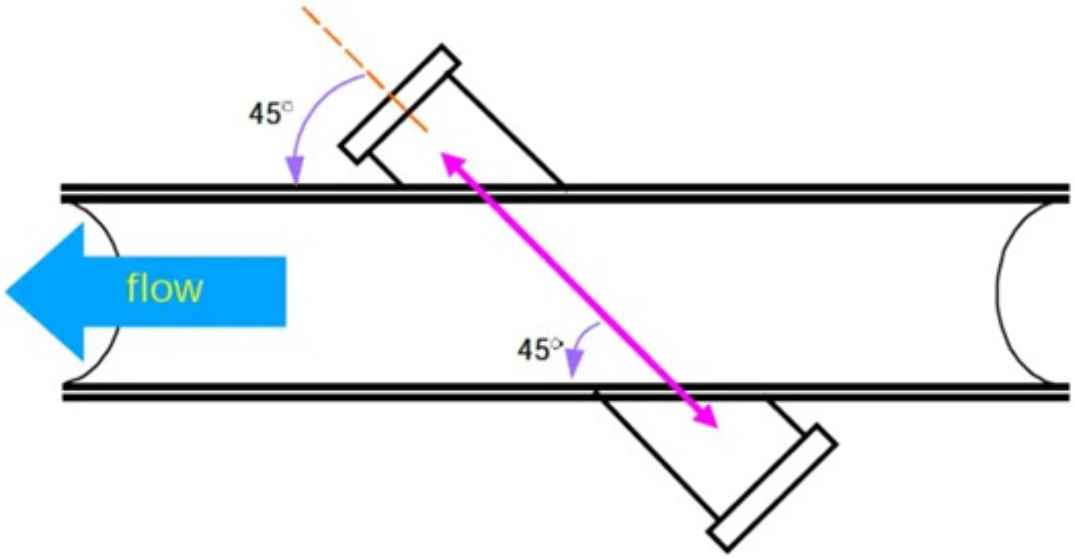

Figure 5B

C) Describe the safety considerations in measurement and storage of cryogenic fluids in industries. **(CO5, BL3, PO1,2, 3, 4)** (2)

-----End-----