Bachelor of Engineering (Mechanical Engineering) - Third Year - Second Semester (Suppl.) 2023

SUBJECT: Experimental Method in Fluid Dynamics

Time: Three hours <div style="float:right">Full Marks 100</div>

[Answer any 5 (five)]

1. Explain the functional components of a measuring instrument with two suitable examples.   20

2a. Distinguish between active and passive transducers with suitable examples.   10

b. Consider a man driving a car along a road. He sees the opportunity to pass and decides to accelerate.
If the light waves entering his eyes are considered input and accelerator-pedal travel as output, is the man functioning as an active or passive transducer? Explain.
If accelerator-pedal travel is considered input and car velocity as output, is the car engine functioning as an active or passive transducer? Explain.   10

3a. Comment on the relative advantages and disadvantages between null and defection methods of measurement. Cite suitable examples against your comments.   10

b. Why Pitot tubes are made L – shaped? Explain.   10

4a. What do you mean by signal filtering? Give suitable example of input and output filtering for elimination of spurious inputs to an instrument.   10

b. Distinguish between i. Analog and Digital Modes of Operation, ii. Interfering and Modified Inputs   10

5. Find the uncertainty in measurement of Fr;

$Fr = u/\sqrt{(gh)}$

u is measured 10 times [in m/s] as 20.2, 21.0, 20.7, 20.5, 20.8, 20.0, 20.8, 20.9, 20.0, 21.0

g is measured 5 times [in m/s^2] as 9.81, 9.80, 9.81, 9.80, 9.81

h is measures 12 time [in mm] as 1000, 1011, 1010, 1019, 1022, 1021, 1011, 1018, 1012, 1010, 1009, 1008.   20

6. The power transmitted by a rotating shaft is given by

$W = 2\pi RFL/t$

If

$R = 1200\pm2$ (rev) is the revolution of shaft during time t

$F = 45 \pm 5\%$ (N) is the force at the end of torque arm

$L = 0.397 \pm 2\%$ (m) is the length of torque arm

$t = 600 \pm 2$ (sec) is the time length of run

For a 95% reliability, calculate the uncertainty in measurement of W.   20

7. Write short notes on:
a. Hysteresis and Dead Space
b. Resolution and Threshold
c. Gimbal Suspension
d. Static sensitivity and Linearity   4x5