Bachelor of Engineering (Mechanical Engineering) - Third Year - Second Semester 2024

SUBJECT: Experimental Method in Fluid Dynamics

Time: Three hours   Full Marks 100

[Answer any 6 (six)]
[4 (four) marks for neatness]

1. Explain the functional components of a measuring instrument with two suitable examples.   16

2a. 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..   8

 b. Comment on the relative advantages and disadvantages between null and defection methods of measurement. Cite suitable examples against your comments.   8

3a. Distinguish between
a. Interfering and Modified Inputs with two suitable examples
b. Analog and Digital Modes of Operation   10+6

4a. What do you mean by method of opposing inputs for rectification of effect of spurious inputs? Explain citing two suitable examples.   10
b. What do you mean by Static Calibration. Write down the steps for the same.   6

5. Find the uncertainty in measurement of Fr;
$Fr = u/\sqrt{(gh)}$
u is measured 12 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, 21.0, 21.0
g is measured 6 times [in m/s^2] as 9.81, 9.80, 9.81, 9.80, 9.81, 9.81
h is measured 18 times [in mm] as 1000, 1011, 1000, 1010, 1019, 1022, 1021, 1011, 1018, 1012, 1010, 1009, 1008, 1011, 1001, 1001, 1001, 1000.   16

6a. 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.   16

7. Write short notes on:
a. Hysteresis and Dead Space
b. Resolution and Threshold
c. Gimbal Suspension
d. Static sensitivity and Linearity   4x4

8a. Using suitable examples, explain the methods of Input and Output signal filtering.
 b. Explain the method of high gain feedback for rectification of spurious inputs for an instrument.   10+6