

DEPARTMENT OF APPLIED MECHANICS

AML 130 [Expt. Methods & Analysis]

MAJOR TEST: II Sem. 2007-2008

Time: 2 Hours

Max Marks: 70

- Q. 1 (a): Name the instruments based on the following physical principles of working. Also, mention some typical applications of these instruments?
(i) Boyle's law (ii) Seebeck effect (iii) Doppler Frequency shift (6)
- Q. 1 (b): Draw the schematic diagram of one of the instruments, either (i) or (iii), clearly showing various components. (5)
- Q. 2. : The electrical resistance of metals and alloys depends on their temperature. How can this property be put to use in the following measurements? Name the corresponding instrument.
(i) Temperature upto 900 K (ii) Fluid velocity
(iii) Very low pressure (iv) Very high pressure (10)
- Q. 3 (a): How are flow-meters different from velocity probes for fluids? Give at least 2 examples of each. Is it possible to determine flow-rate through a circular pipe, using a velocity probe and a suitable procedure? (5)
- Q.3 (b): In the context of temperature measurement draw the following response curves:
(i) Vapour pressure vs. temperature for a vapour pressure thermometer.
(ii) Resistance vs. temperature for a thermistor chip.
(iii) Radiation energy vs. wave-length of radiation at three different temperatures. In case (iii), what features of the curves are useful in temperature measurement? (8)
- Q. 4 : State True / False for the following statements. All parts of this question must be answered on a single page and in the same sequence. A wrong answer carries 50% penalty.
(i) A Proving Ring is a device in which Newton's rings are used to measure displacement.
(ii) It is essential that a rotameter is installed vertically for flow measurement.
(iii) Stefan-Boltzmann Law is applicable for heat transfer by radiation only.
(iv) Very small force (~ 1N) can be measured easily by using a hydraulic load cell.
(v) Slip rings are used to dissipate heat in mercury cups in friction-type dynamometers.
(vi) Pitot-static tube is suitable for measuring very low flow velocities. (6)

Q. 5 (a): Show that the maximum value of the probability density function for a Gaussian distribution is:

$$\{P(x)\}_{\max} = \frac{0.399}{\sigma}$$

where σ is one of the two parameters of the distribution. Show that if σ is small, the distribution has a sharper peak and it is flatter for large values of σ . (6)

Q. 5 (b): Two mating parts are being received from two different suppliers. Random samples of each were analysed and the following results obtained:

	\bar{x} , em	σ , cm	n
Female	0.510	0.020	100
Male	0.495	0.021	50

Determine the maximum and minimum tolerance at 99% level of confidence. (6)

Q. 6: Define the individual terms in the following pairs and illustrate, with suitable examples, the difference between the terms (in each pair):

- (i) Error vs. mistake
- (ii) Sensitivity vs. reliability
- (iii) Random error vs. systematic error
- (iv) Precision vs. precision of the means for a given measurement system. (10)

Q. 7: What are dynamometers used for? What are their main types? Discuss a non-friction type dynamometer suitable for a large output engine, stressing its working principle and using a schematic diagram? (8)