

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), November 2017

M. Tech. in Thermal Engineering, Semester I

Roll No.....

TEMTECH 104: Experimental Methods in Thermal Engineering

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
 2. Assume suitable data wherever required and mention it clearly.
 3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
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Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10

- i. Which of the following temperature measuring instruments need not touch the object whose temperature is being measured?
 - A. Mercury in glass thermometer
 - B. Radiation/infrared pyrometer
 - C. Thermo electric pyrometer
 - D. Filled system thermometer
- ii. Which of the following is the dynamic characteristic of an instrument?
 - A. Sensitivity
 - B. Reproducibility
 - C. Dead zone
 - D. Fidelity
- iii. The operation of a rotameter is based on
 - A. Rotation of a turbine.
 - B. Variable flow area.
 - C. Pressure drop across a nozzle.
 - D. Pressure at a stagnation point.
- iv. Smoke density of the flue gas going out of the chimney is measured by a
 - A. thermal conductivity meter
 - B. polarograph
 - C. photo electric cell
 - D. chromatograph
- v. Working principle of radiation pyrometer is based on the
 - A. Wien's law
 - B. Stefan-Boltzman law
 - C. Kirchoffs law
 - D. Seebeck effect
- vi. Thermistor, which has high temperature co-efficient of resistivity, is used as the sensing element in resistance thermometer. It is a/an:
 - A. Conductor
 - B. Insulator
 - C. Liquid semiconductor

	D. Solid semiconductor	
vii.	The ionization gauge an instrument used for the measurement of A. Very low pressure B. Medium pressure C. High pressure D. Very high pressure	
viii.	A scale which is used to measure the acidic or alkaline nature of a substance is called A. Indicator B. pH scale C. pH meter D. balance scale	
ix.	Unit of specific heat is? A. $\text{J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$ B. $\text{J mol } ^\circ\text{C}^{-1}$ C. $\text{J kg}^{-1} \text{ } ^\circ\text{C}$ D. $\text{J mol}^{-1} \text{ } ^\circ\text{C}$	
x.	Unit of heat capacity is? A. $\text{J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$ B. $\text{J } ^\circ\text{C}^{-1}$ C. $\text{J kg}^{-1} \text{ } ^\circ\text{C}$ D. $\text{J mol}^{-1} \text{ } ^\circ\text{C}$	
Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i.	Explain the difference between accuracy and precision in an instrument.	
ii.	Mention the limitations of obstruction type flowmeters?	
iii.	Find the absolute pressure, if a pressure gauge reads 8.3psi, while the atm pressure is 14.7psi.	
iv.	If a pool has a water with a depth of 6 ft. Find the pressure at the bottom of the pool in Pa. (assume density = 10^3kg/m^3)	
Q.3A	Explain the role of environmental effects in various analytical measurements.	05
Q.3B	Compare the shear stress vs shear rate behavior of Newtonian, pseudo plastic and Bingham plastic fluids with the help of suitable graph and examples?	05
Q.4A	What are the differences between RTD and thermistors type temperature measurement devices?	05
Q.4B	What are the characteristics of an optical pyrometer?	05
Q.5A	What are important factors to select a suitable pressure measurement instrument?	05
Q.5B	Define sensitivity of a measuring instrument.	05
Q.6	Explain with the help of a suitable sketch, the working principle of an electrical resistance pressure gauge.	10
Q.7	A brass rod is stress-free at room temperature (20°C). It is heated up, but	10

prevented from lengthening. At what temperature does the stress reaches -172 MPa? (Linear thermal expansion coefficient of brass is $20 \times 10^{-6} / ^\circ\text{C}$. Young's modulus is 100 GPa for brass.)

OR

Q.7 A copper wire 15 m long is cooled from 40 to -9°C . How much change in length will it experience? Linear thermal expansion coefficient for Cu is $16.5 \times 10^{-6} / ^\circ\text{C}$. 10

Q.8 Describe different types of instruments and their applications for measurements. 10

Q.9A Describe the working principles of McLeod gauge with the help of suitable diagrams. 10

Q.9B Describe the working principles of Pirani gauge with the help of suitable diagrams. 10

OR

Q.9B Explain type of infrared temperature sensors. 10