UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATIONS, NOV. / DEC. 2018

COURSE NO: MR 373
COURSE NAME: PROCESS INSTRUMENTATION
CLASS: MR III **TIME:** 3 HOURS

Name**:** _____Index Number: _____

Answer All questions in the Answer Booklet. Neat working will be REWARDED.

Instrument manufacturers and a few large users usually take ----standards because they are expensive to own and maintain. (a) Primary (b) Secondary (c) Tertiary (d) No

1. Pure metals mostly have practically --- scale in resistance with temperature. (a) Non linear (b) Linear (c) Elliptic (d) Congruent

2. In thermistors, a small temperature increase leads to a --- in resistance. (a) Small decrease (b) Large decrease (c) Small increase (d) Large increase

3. The ---- forms the basis of one of the very important methods of measuring temperature. (a) Salt bridge (b) Seebeck effect (c) Samuel's Law (d) Pirani effect

4. , ---- states that, a thermoelectric current cannot be sustained in a circuit of a single homogeneous materials. (a) Heterogeneous (b) Homogeneous (c) Hydrogenous (d) Hypergeneous

5. The total emissivity of a body is the emissive power over the whole --- radiation wavelength. (a) Base thermal (b) Band thermal (c) Broad thermal (d) Bad thermal

6. The most frequently used optical pyrometer is the ---.filament pyrometer. (a) Appearing (b) Approaching (c) Disappearing (d) Regrouping

7. ---- may be used to measure temperatures between 600- 3000^{o}C. (a) Thermometers (b) Optical pyrometers (c) Audio pyrometers (d) Radial pyrometers

8. Pyrometers are often considered ---- than other temperature measuring devices. (a) Much cheaper (b) Cheaper (c) more expensive (d) None of the above

9. ---- is capable of measuring temperatures of moving bodies. (a) Thermometers (b) Thermistors (c) Pyrometers (d) Galvanometers

10. The normal temperature range for paints and crayons is from ----. (a) 100 – 1000^{o}C (b) 50 – 500^{o}C (c) 25 – 600^{o}C (d) 30 – 700^{o}C

11. All bodies with Kelvin temperatures more than zero Kelvin, have the ability to ---**Q12**--- and ---**Q13**--- energy from other bodies. **Q12.** (a) Reflect (b) Raise (c) Radiate (d) Rotate

12. **Q13.** (a) Adsorb (b) Absorb (c) Assorb (d) Resorb

13. Energy transmitted by bodies is often in the form of ---**Q14**--- waves and they travel at the speed of ---**Q15**---. **Q14**. (a) Electric (b) Electronic (c) Electromagnetic (d) Electro-sonic

14. **Q15**. (a) Sound (b) Microwave (c) Electrons (d) Light

15. Black bodies are bodies with absorptive power ---- unity. (a) More than (b) Less than (c) Equal to (d) Greater than

16. Water is said to be unsuitable as a temperature measuring liquid because its ---**Q17**--- does not ---**Q18**--- **Q17**. (a) Water pressure (a) Melting point (b) Boiling temperature (d) Vapour pressure

17. **Q18**. (a) Decrease linearly (b) Increase Linearly (c) Increase exponentially (d) Decrease exponentially

18. Measurement instrumentation is a characteristic in the industry to serve as ---**Q19**--- of ---**Q20**--

Q19. (a) Basis (b) Feed (c) Pulp (d) Density

19. **Q20**. (a) Current (b) Control (c) Circuit (d) Count

20. Audible and inaudible sound waves are classified under --- variables. (a) Actual (b) Acoustic (c) Coustic (d) Ascoustic

21. The net emf of a thermocouple is a function of the two ---**Q22**--- used and the ---**Q23**--- at the two junctions. **Q22**. (a) Materials (b) Currents (c) Energies (d) Distances

22. **Q23**. (a) Pressure (b) Volume (c) Area (d) Temperature

23. ---- pressure is when one end of the U-tube is at atmospheric pressure. (a) Absolute (b) Differential (c) Gadge (d) Gauge

24. Two unknown pressures none of which is at atmospheric pressure is called ---- pressure. (a) Difflectional (b) Diffractional (c) Differential (d) Absolute

25. Which of the following instrument is a stress – in – a - chamber type equipment? (a) Katharometer (b) Bourdon tube (c) Closed-limb tube (d) Thermometer

26. Barometer is a well-type ---**Q27**--- leg manometer with the column above the ---**Q28**--- evacuated so that the scale reading can be ---**Q29**---.

Q27. (a) Simple (b) Sample (c) Siring (d) Single

27. **28**. (a) Water (b) Mercury (c) Alcohol (d) Methylene

28. **Q29**. (a) Gauge pressure (b) Gauge temperature (c) Absolute pressure (d) Absolute temperature

29. The inclined limb manometer is employed when ---**Q30**--- pressure, ---**Q31**--- sensitivity is

required in the pressure measurement. **Q30**. (a) Low (b) High (c) Very low (d) Very high

30. **Q31**. (a) Greater (b) Smaller (c) No value (d) Normal

Section B (Answer ALL Questions)

Question 1

a. List ten composition measuring instruments usually employed in industrial processes.

b. State the two types of strain gauges which are used industrially and explain how these instruments are used.

c. Draw and label carefully the Pirani Vacuum gauge

d. With a labeled diagram, explain how several thermocouples can be connected in parallel and be used to measure average temperature of a system. Note the terminal arrangement of the circuits.

e. Draw and label the Oriface meter and state the advantages and the disadvantages of this meter.

Question 2

a. Name six measuring instruments used in pressure determination you know of.

b. With labeled diagrams, explain the following:

i. Gauge pressure

ii. Differential pressure

iii. Absolute pressure

c. With the help the Well-type manometer diagram, prove that,

P_1-P_2 = $\rho g h_c$, where h_c is increase level of column, P_1 and P_2 are pressures applied.

d. Draw well labeled diagrams of;

i. The C-type Bourdon tube

ii. The disappearing filament Pyrometer

iii. The Ionisation Gauge (Alphatron)

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