Y 5106

M.E. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006.

Second Semester

Internal Combustion Engineering

IC 038 — INSTRUMENTATION IN THERMAL ENGINEERING

(Common to M.E. – Energy Engineering M.E. – Thermal Engineering, and
M.E. – Refrigeration and Air conditioning)

(Regulation 2002)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

Use of Approved Charts, Tables and data book are permitted.

PART A — (10 × 2 = 20 marks)

1. Explain systematic and random errors.

2. Define linearity and sensitivity of instruments.

3. Compare digital and analog representations of signals for data transmission.

4. Mention the need for Analog–to–Digital and Digital–to–Analog converters in data transmission.

5. What is the physical significance of the law of intermediate temperatures and the law of intermediate metals in relation to thermocouples?

6. It is desirable that the mass of the monometric fluid in a manometer (used for pressure measurement) is less. Explain why?

7. What is the concept of Doppler effect?

8. What do you mean by telemetry systems?

9. What is meant by 'Isokinetic sampling'?

10. Explain the principle of thermal gas analyser.

11. (a) Write notes on the following :

    (i) Desired inputs and spurious inputs   (4)

    (ii) Active and passive transducers   (4)

    (iii) Threshold and Resolution   (4)

    (iv) Static stiffness and impedence.   (4)

Or

(b) (i) A balloon carrying a first–order thermometer with a 15–seconds time constant rises through the atmosphere at 6 m/s. Assume temperature varies with altitude at 0.15°C/30 m. The balloon transmits temperature and altitude readings back to the ground. At 3000 m, the balloon says the temperature is 0°C. What is the true altitude at which 0°C occurs?

    (ii) A thermometer has a time constant of 10 seconds and behaves as a first–order system. It is initially at a temperature of 30°C and then suddenly subjected to a surrounding temperature of 120°C. Calculate the time to attain 99 percent of the steady–state temperature.   (8 + 8)

12. (a) With the help of a block diagram, explain the working of a data acquisition and processing system showing the major elements.

Or

(b) (i) Explain any two intelligent instruments for error reduction in measurements.

    (ii) Write notes on experimental planning.   (8 + 8)

13. (a) (i) The energy emitted from a piece of metal is measured, and the temperature is determined to be 1050°C, assuming a surface emissivity of 0.82. It is later found that the true emissivity is 0.75. Calculate the error in the temperature determination.

    (ii) Explain briefly the sources of error in the temperature measurement of flowing fluids.   (8 + 8)

Or

(b) Write short notes on :

    (i) Hot wire anemometer

    (ii) McLeod gauge.   (8 + 8)

14. (a) Write notes on :

    (i)   Schlieren

    (ii) Interferometer.   (8 + 8)

                          Or

    (b) (i)   Describe the working of Gardon heat–flux meter

        (ii) Explain the working of Laser Doppler anemometer.   (8 + 8)

15. (a) Explain, with the help of a neat sketch, the working principle of gas chromatograph. What are its limitations?

                          Or

    (b) (i)   Explain any one method for smoke density measurement.

        (ii) Write notes on Non–Dispersive Infra–Red analyser.   (8 + 8)

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