

The figures in the margins indicate full marks

Use separate Answer Script for each Group

GROUP-A

Answer any *five* questions :

5 x 10

1. Discuss Optical Pyrometer and total Radiation type Pyrometer. Compare their practical applications. The emitted radiation energy from a piece of metal is measured and temperature is found to be 1065 °C(surface emissivity~0.82), calculate the error in temperature measurement if true emissivity ~0.75. 4+4+2 = 10
2. Describe with necessary figure the working principle of McLeod gauge and thermocouple gauge. What are advantages of electronic pressure transducer(EPTs) over mechanical pressure transducer? Write down the working formula for Capacitive Pressure Transducer. 2.5X2+4+1=10
3. With the help of a neat labeled diagram, describe the use of a resistive hygrometer for measurement of humidity. What are the precautions to be taken for the measurement? What is the accuracy of this method? When will the readings of a wet bulb and dry bulb thermometer be same? and why? 4+3+1.5X2 = 10
4. State Weins displacement law of radiation and obtain Stefan's law. Write notes on vapor pressure thermometer. 5+5 = 10
5. Write the phenomena on the basis of which Viscosity measurement are carried out. Explain the procedure with neat diagram for measuring viscosity for a process fluid in industry using capillary flow based Viscometer. What is Redwood Viscometer? 2+6+2=10
6. Describe the working principle of strain gauge pressure transducer,(with diagram). Write down short notes on Magnetic float level indicator and Dip stick. 5+5=10
7. Write short notes on any two the following:
 - (a) Working principle of Piezoelectric Hygrometer.
 - (b) Estimate e.m.f. of a thermocouple from thermoelectric diagram.
 - (c) Ultrasonic method for measurement of thickness. 5X2 = 10

Group: B (50 marks)

Answer any five questions

8. What is Routh array? How is it utilized for prediction of stability of a control system? The characteristic equation of a closed loop system is given by; $s^5+s^4+3s^3+3s^2+2s+2 + 0$ Examine the stability of the system in detail through Routh's criteria and algorithm. 1+3+6=10
9. How are the responses of a process affected by change of controller parameters specially when PID controller is used? Discuss appending graphs. Discuss the Ziegler-Nichols methods of adjustment of parameters of a PID controller presenting them in Table(s). 5+5 = 10
10. (a) Define deviation reduction factor, proportional control factor and subsidence ratio. How do these contribute to determine relative stability of a system? Deduce necessary any relation. (b) Two systems one with and another without offset have same proportional control factor and subsidence ratio of 13 and 4 respectively, obtain their ratio of controllability figure. 7+3=10

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- 11.(a) Draw the block schematic diagram of a single loop feedback control system showing the essential components as also upset/disturbance entering into the system. Label the diagram explicitly.
 (b) What are the types of control actions generally used in industrial systems? Show the action processes by equations or state diagrams. 5+5=10
12. An ideal integrating process of order one has a static gain of 0.4 and a time constant of 3.1s. The response of the system with on-off controller of peak output 2.2 units shows a differential gap of ± 1.3 units when the dead zone of the controller is ± 0.22 units. What is the system dead time? Deduce the relation you use. 10
13. Draw the basic scheme of a programmable Logic Controller(PLC). The Boolean function of the ladder for setting the program of a PLC is given as,

$$\text{OUTS} = [(\text{IN2} + \text{IN3}) \cdot \text{IN1}] + \text{IN4}$$
 Show the steps adopted for programming to be made in the controller. 5+5=10
14. Sketch a basic pneumatic PID controller and derive its transfer function when it uses a flapper nozzle assembly whose gain is very high to allow assumptions made in the derivation to be reasonable. 10
15. Write short notes on any two of the following:
 (a) Bode plot (b) Feed-forward control (c) Digital controller (d) Nyquist criteria 5X2=10