Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech.**
PEI6I101

6th Semester Regular Examination 2017-18
PROCESS CONTROL
BRANCH : AEIE, EIE, IEE
Time : 3 Hours
Max Marks : 100
Q.CODE : C152

Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

Q1 **Answer the following questions : *multiple type or dash fill up type :*** **(2 x 10)**

a) Determine how many bits a D/A converter must have to provide output increments of 0.04 V or less. The reference is 10 V
a) 8 b)7 c) 10 d) 6

b) A S/H has a 50-ns aperture time and a 4-μs acquisition time, and the ADC has a 40 μs conversion time. The maximum throughput frequency is ----------.

c) Suppose a process error lies within the neutral zone with p = 25%. At t = 0, the error falls below the neutral zone. If K =+2% per second, find the time in sec, when the output saturates.
a) 30 b) 37.5 c) 100 d) 12

d) --------- Circuits are used to convert impedance variation into voltage variation.

e) Find the Hexa word those results from a 3.127-V input to a 5-bit ADC with a 5-V reference.
a) 15H b) 37H c) 20H d) 14 H

f) --------- Material is being used for J-Type thermocouple.

g) For metal gauges the gauge factor(GF) number is close to
a) 2000 b)70 c) 2 d) -200

h) The different types of accelerometer are ------, -------, ------, --------.

i) Solid-state pressure sensors work in the range of
a) 0 to 100 kPa b) > 1000 kPa c) 10^{-3} kPa d) none of these

j) An object is approximately 300 m away. The approximate time difference to calculate the distance, using a light pulse reflected from the object is -----.

Q2 **Answer the following questions : *Short answer type :*** **(2 x 10)**

a) Why current transmission is used in analog signal conditioning?

b) Develop an op amp circuit that can provide an output voltage related to the input voltage by $V_{out} = 3.4\ V_{in} + 5$?

c) Why hysteresis comparator is required?

d) Define process load?

e) Give some application of Bimetal strips.

f) What is the role of IP (index of performance) in adaptive control system?

g) “Ratio control is a type of feed forward control”. Justify the statement.

h) What is working principle of Pneumatic Actuator?

i) Give one example of two-position discontinuous controller mode.

j) Explain the working of Photovoltaic detector?

Part – B (Answer any four questions)

Q3 **a)** A signal-conditioning system uses a frequency variation from 6 kHz to 60 kHz to carry measurement information. There is considerable noise at 120 Hz and at 1 MHz. Design a band-pass filter to reduce the noise by 90%. What is the effect on the desired pass band Frequencies? **(10)**

b) A sensor outputs 0 to 1 V. Develop a voltage-to-current converter so that this becomes 0 to 10 mA. Specify the maximum load resistance if the op amp saturates at ± 10 V. **(5)**

Q4 **a)** Explain the ADC characteristics briefly. Also explain the different approaches for the conversion process. **(10)**

b) A measurement of temperature using a sensor that outputs 6.5mV/°C must measure to 100°C.A 6-bit ADC with a 10-V reference is used. (a) Develop a circuit to interface the sensor and the ADC. (b) Find the temperature resolution. **(5)**

Q5 **a)** A sample of metal resistance versus temperature has the following measured values : **(10)**

T(°F)	R(Ω)
60	106.0
65	107.6
70	109.1
75	110.2
80	111.1
85	111.7
90	112.2

Find the linear approximation and quadratic approximation of resistance versus temperature between 60° and 90°F.

b) Explain the techniques for reference junction compensation of thermocouple. **(5)**

Q6 **a)** A CdS cell has a dark resistance of 100 kΩ and a resistance in a light beam of 30 kΩ. The cell time constant is 72 ms. Devise a system to trigger a 3-V comparator within 10 ms of the beam interruption. **(10)**

b) Explain the final control operation and its each element briefly. **(5)**

Q7 **a)** State a basic structure of the programmable logic controller with some examples. **(10)**

b) How does override control protect the drum boiler from overheating? **(5)**

Q8 **a)** Discuss the various discontinuous and continuous controller modes with their applications. **(10)**

b) Compare the Feedforward and Feedback control briefly. **(5)**

Q9 **a)** A temperature-control system inputs the controlled variable as a range from 0 to 4 V.The output is a heater requiring 0 to 8 V. A PID is to be used with K_p = 2.4%/%,K_t = 9%/(%/min),K_d = 0.7%/(%/min).The period of the fastest expected change is estimated to be 8 s. Develop the analog PID circuit. **(10)**

b) Illustrate with some example showing ratio-control configuration. **(5)**