6ᵗʰ Semester Back Examination 2018-19
PROCESS DYNAMICS AND CONTROL
BRANCH : CHEM
Time : 3 Hours
Max Marks : 70
Q.CODE : F135
Answer Question No.1 which is compulsory and any FIVE from the rest.
The figures in the right hand margin indicate marks. The ordinary, semi-log and log-log graph papers should be provided to the students in the examination hall.

Q1   **Answer the following questions :**   **(2 x 10)**

     a) Differentiate between Feedback and Feed forward control configuration.

     b) Give any two examples of forcing function.

     c) Write the transfer function of first order sytem with transportation lag.

     d) Show the graphical representation of step and ramp forcing function.

     e) Give an example of an on-off controller.

     f) State the Bode stability criterion.

     g) Write the transfer function of PID controller.

     h) What do you mean by Integral square of error?

     i) Define band width.

     j) Write the properties of critically damped system.

Q2   **a)** Derive the transfer function of mercury in glass thermometer.   **(5)**

     b) Two non-interacting tanks are connected in series. The time constant are $\tau_2=1$ and $\tau_1=0.5$, $R_2=1$. Determine the response of the level in tank 2 if a unit step change is made in the inlet flow rate to tank 1.   **(5)**

Q3   Classify the different types of controller and derive their transfer functions.   **(10)**

Q4   **a)** State the Routh Array stability criterion.   **(5)**

     b) Check the stability of a control system whose characteristics equation is given by: **(5)**

$$s^4 + 3s^3 + 5s^2 + 4s + 2 = 0$$

Q5   **a)** Prove that the offset value of PI controller is zero by taking any suitable example.   **(5)**

     b) Draw the Bode plot of PD controller.   **(5)**

Q6   Write the procedure to draw the Root locus plot.   **(10)**

Q7   The transfer function of the control system is given by   **(10)**

$$G(s) = \frac{16}{1.5s^2 + 2.4s + 6}$$

A step change of magnitude 6 is introduced into the system. Calculate:

    a) Overshoot
    b) Period of oscillation
    c) Natural period of oscillation
    d) Rise time
    e) Ultimate value of response
    f) Maximum value of response

Q8   **Write short answer on any TWO :**   **(5 x 2)**

    a) Transportation lags.
    b) Damping factor
    c) Zigler-Nicol controller settings