## B.F.T.B.E.-4TH YEAR-1ST SEM- EXAM ( SUPPLEMENTARY ),2017

### INSTRUMENTATION AND PROCESS CONTROL

Time: Three hours                                          Full Marks: 100

Use separate  Answer Script for each  Part

### PART-I ( 50 Marks )

**Answer any  Three questions. All questions carry equal marks**

1. a)  What  are  the Laplace transformations  of ---

    step input of magnitude A  ?

    impulse magnitude of B ?

    sinusoidal input of magnitude  A Sin wt?  ( 3+ 3+3)

   b) Write the notational form of the first order transfer function containing
   time constant  t.                                          ( 3 )

   c )Write the notational form of the second order transfer function  containing
   Time constant  t                                          (2 )

   d )Write the Laplace transform  of      d Y ( t ) / dt         $(2\frac{2}{3})$

2. ( a )  What  are the responses of ---------

   First order system to step input of magnitude A ?

   First order to impulse input of magnitude B ?          ( 3+3)

[ Turn over

( b ) Write the Laplace transform of the equation and also find the time constant  t

$$m \frac{d^2 Y(t)}{dt^2} + a\, C_d \frac{d Y(t)}{dt} + a\, p_m\, g\, Y(t) = a\, X(t)$$

( 4 )

( c ) Using the  following equation draw the block diagram of a closed loop transfer function for  regulatory control  system resulting from the change of load in absence of variation of set point.

$$Y(s) = \frac{G_p\, G_c\, G_v\, Y_{set}(s) + G_p\, U(s)}{\left[\, 1 + \, G_p\, G_v\, G_m\, G_c \,\right]}$$

$(6\frac{2}{3})$

3.    Deduce the basic  equations and discuss the first order  behavior  of a tank temperature  T ( t) of the steam heated tank  resulting from a step Change in heating rate  Q ( t ).                    $(16\frac{2}{3})$

4. Deduce the basic equations and discuss the response characteristics of the  flow rates of n  number of  tanks connected  in series with  interacting  system.
(                                                               $( 16\frac{2}{3})$

5. Deduce the  Laplacian Transfer function  block diagram of pressure transducer.

$( 16\frac{2}{3})$

**Ref. No.: EX/FTBE/T/412/2017 S**

BACHELOR OF ENGINEERING ( F.T.B.E) EXAMINATION, 2017

(4$^{th}$ Year -1$^{st}$ Semester, Supplementary)

**Instrumentation & process control**

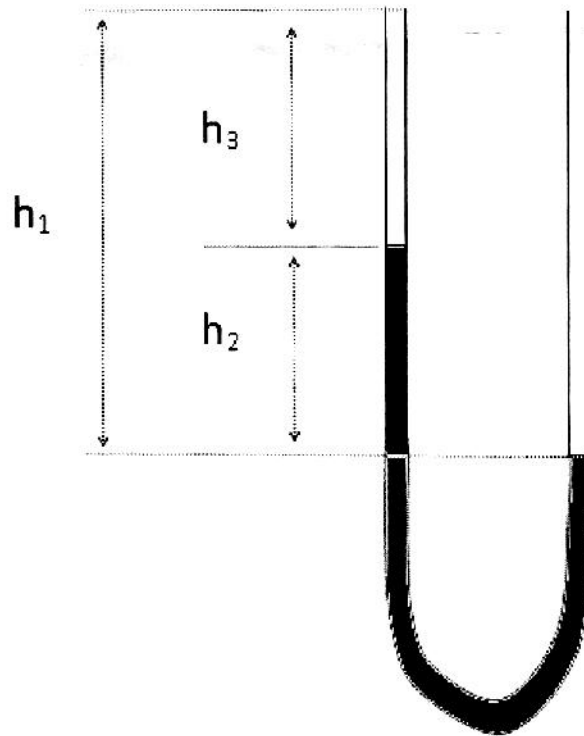Time: 3 hrs.                                                                 Full Marks : 100

(Use separate answer script for each part)

Part-II

[Answer question no. 1 and any two from the rest, Marks 50]

1.    Petroleum oil ($\rho_o$=900kg /m$^3$, $\mu$=38.8mPa-s) is flowing isothermally through a horizontal pipeline with an inner diameter of 102mm. A properly designed Pitot tube is inserted at the centre line of the pipe, its leads are filled with oil and attached to a vertical U-tube containing both oil and water . The difference in the water levels in the manometer is 900mm. calculate the rate of oil flow in l/s.The manometer reading is generally expressed as m of oil                                                                                 (18)

2.    State the basic principles of ( 3-effects) based upon which the thermocouple works to measure the temperature of a body. Name the elements from which the thermocouples are made and state also the usual temperature range up to which the thermocouples are capable to measure the temperature.                                                       (16)

3.    Write short note on ( any two ):                                                                 (8x2)

    (a)    Separation of volatile components in a mixture by Gas Chromatographic technique

    (b)    Pressure measurement of a system by a suitable Pressure Gauge

    (c)    Use of Hydrostatic Head meters to measure the level of a liquid in a tank

    (d)    Measurement of gas flow by Hot-wire Anemometer

3. Why it is necessary to measure the viscousity of fermented broth ( mainly by mold) from time to time in an industrial fermenter ? Suggest a suitable device by which you will be able to measure the viscousity of the broth. (16 )

4. (a) Write short note on the use of Hydrometer to determine the sp. gr. of a liquid. Discuss the principle of marking off a scale on the stem of the hydrometer giving the sp. gr. values directly.

(b) A simple U-tube can be used to determine the sp. gr. of liquids which are more dense than water by the arrangement shown in the figure. Derive an expression for sp. gr. in terms of $h_1, h_2$ and $h_3$



(8 + 8 )

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