(A constituent unit of MAHE, Manipal)

FIFTH SEMESTER B. TECH. (INSTRUMENTATION AND CONTROL ENGG.)

END SEMESTER DEGREE EXAMINATIONS, DECEMBER – 2018

SUBJECT: PROCESS INSTRUMENTATION & CONTROL [ICE 3106]

TIME:	3	HO	URS
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MAX. MARKS: 50

3M

2M

2M

Instructions to candidates		
•	Answer ALL questions.	
•	Missing data may be suitably assumed.	

- 1A With an example explain self-regulation and non self-regulation process.
- 1B The two-tank system shown in Fig. Q1B is operating at steady state. At time t_0 , 10 ft³ of water 4M is quickly added to the first tank. Determine the maximum deviation in level (feet) in both tanks from the ultimate steady-state values and the time at which each maximum occurs. Data:
 - $A_1 = A_2 = 10 \text{ ft}^2$
 - $R_{\rm l} = 0.1 \, {\rm ft/cfm}$
 - $R_2 = 0.35 \text{ ft/cfm}$
- 1C Describe the characteristics of two position and floating mode controller. 3M
- 2A With necessary equation and graph explain the characteristics of PD controller. A PD controller 5M has $K_P= 2$, $K_D= 2s$, and $P_0= 40\%$. Plot the controller output for the error of Fig.Q2A.
- 2B For a proportional controller, the controlled variable is a process temperature with a range of 50 3M to 130^oC and a setpoint of 73.5^oC. Under nominal conditions, the setpoint is maintained with an output of 50%. Find the proportional offset resulting from a load change that requires a 55% output if the proportional gain is (a) 0.1, (b) 0.7, (c) 2.0, and (d) 5.0.
- 2C Explain the concept of degrees of freedom with an example.
- 3A A PID controller tuned by ZN-Closed loop method gave the response shown in Fig.Q.3A for 5M various values on K_P. Describe the procedure to obtain the controller parameters from the response and write the different gains of PID block.
- 3B Discuss about the three major Time-integral performance criteria used for controller 3M performance evaluation.
- 3C How quarter decay ratio is superior to other performance criteria for controller evaluation? 2M
- 4A List the procedure for tuning a PID controller using reaction curve method. 4M
- 4B With required block diagrams explain the design of a Feedforward controller considering the 4M transfer functions of the sensing element and the final control element.
- 4C Compare a ratio controller with a normal feedback controller.
- 5A Compare and contrast Model reference adaptive controller with Self tuning regulators. 4M
- 5B What are the process requirements and considerations for implementing a cascade controller in 4M a control loop? Explain with an example process.
- 5C Derive the controller equations of an IMC controller assuming accurate knowledge of all the 2M components are available.


