Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

FIRST SEMESTER M.TECH. (CONTROL SYSTEMS)

END SEMESTER EXAMINATIONS, NOV - 2017

SUBJECT: PROCESS DYNAMICS AND CONTROL [ICE 5121]

Duration: 3 Hour Max. Marks:50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A Define degrees of freedom. 2

1B Brief on the selection of control valves. 3

1C For an interacting two tank system with two inputs U1 and U2, find the heights of the tank 1 and tank 2 with respect to step change in U1 with proper derivation. 5

2A With sketches explain the linear control valve with its expression. 2

2B Prove that the proportional controller will result with offset in servo and regulatory mode. Consider the first order process transfer function while deriving for offset. 3

2C With the neat block diagram and P&I diagram explain the hydraulic PD controller. Also derive for the Kp and Kd parameters of the PD controller. 5

3A The transfer function of the interacting system is given by $G(s)=\frac{1}{s(s+1)(s+5)}$, identify the optimal values of the PID controller based on ultimate cycle method of tuning. 2

3B Derive for the manipulated variable for the static and dynamic Feed-Forward controller with neat sketches. 3

3C The transfer function for a cascade system are given as: 5

$G_{p1}(s)=\frac{5}{(3s+1)(4s+1)}$; $G_{p2}(s)=\frac{4}{(s+1)}$; load $G_{l2}(s)=\frac{1}{(3s+1)}$. Both the controller used are proportional in nature. G_{c2}=5. G_{m1}=0.05 and G_{m2}=0.2.

a) Calculate the ultimate value of K_{p1} for primary controller for which simple feedback and cascade loop go into oscillation.

Compare the offset for simple feedback and cascade loop when K_{p1}=12.

4A	Write the merits and demerits of pneumatic controller in comparison with the electronic controller.	2
4B	With neat block diagram explain the concepts of dead time compensator with necessary derivations.	3
4C	Explain briefly about the Internal Model Controller design and its issues. Also derive for the PI control parameters with FOP model and PID control parameters for the FOPDT model.	5
5A	Write a short note on I/P and P/I converter with its sketches.	2
5B	The task assigned is to design the cross controllers for the MIMO interacting system. Consider the 2 x 2 general feedback model and solve for cross controllers.	3
5C	With expressions explain the selection of control loops based on RGA. Also show the calculations of RGA ‘with all loop open’ and ‘one loop closed’. Interpret the results with respect to RGA values.	5

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