Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – WINTER 2015

Subject Code: 171701 **Date:12/12/2015**

Subject Name: Control System Design

Time: 10:30am to 1:00pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Enumerate internal model design for step input tracking with suitable mathematical justification. **07**

(b) Explain Pseudo Quantative Feedback theory with suitable Example. **07**

Q.2 **(a)** What is the importance of sensitivity in robust control? Explain the analysis of robust control system in the same context. **07**

(b) Explain the compensator design with integrated full-state feedback and observer. **07**

OR

(b) Give the design of robust PID control system. **07**

Q.3 **(a)** Give syntax, output and explanation of seven commands used in MATLAB for state variable analysis and compensation. **07**

(b) Explain the control of uncertain parameter in robust control system. **07**

OR

Q.3 Determine the observability and controllability of system having Transfer function $\frac{Y(s)}{U(s)} = \frac{2}{s^3+6s^2+11s+6}$. **14**

Q.4 **(a)** Explain dead beat response and narrate the design process for it. **07**

(b) Explain ZOH and compensate closed loop control system with digital computer realization. **07**

OR

Q.4 **(a)** Derive the Z transformation for $x(n) = a^n (\cos w_0 n)\, u(n)$ **07**

(b) Determine inverse z transformation using partial fraction expansion **07**

$$X(z) = \frac{1 + z^{-1}}{1 - z^{-1} + 0.5z^{-2}}$$

Q.5 **(a)** Design a suitable compensator for type 2 system with an open loop transfer function $G(s) = K/[s^2(s+1.5)]$ to meet following specification. **14**

Settling time $\leq$ 4 second, peak over shoot for step $\leq$ 20%

OR

Q.5 Design a phase lead compensator for a system having open loop transfer function $G(s)H(s) = K/[s^2(1+0.05s)]$ for acceleration error constant K_a =100 sec^{-2} and PM= 50^o. **14**

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