Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

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

END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: LINEAR CONTROL THEORY [ICE 2203]

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Semilog graph sheet will be supplied

1A. Write down the force current analogy of the mechanical system elements. **2**

1B. Derive the transfer function of a field current controlled D.C servomotor **3**

1C. Derive the transfer function of the Ladder network shown in Fig Q1C **5**

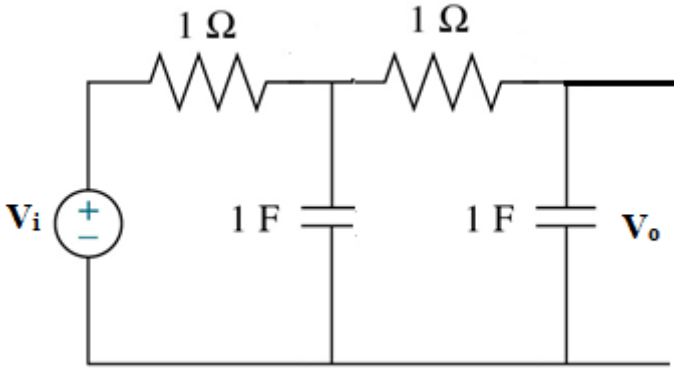

Fig Q1C

2A. Explain the block diagram reduction rules for (i) moving a pick off point ahead of the block (ii) Moving a pick off point beyond the block. **2**

2B. Derive the expressions for K_p, K_V, and K_a for a unity feedback control system **3**

2C. Using Mason's gain formula reduce the signal flow graph shown in Fig Q2C and find the overall transfer function $\frac{y_6(s)}{y_1(s)}$ **5**

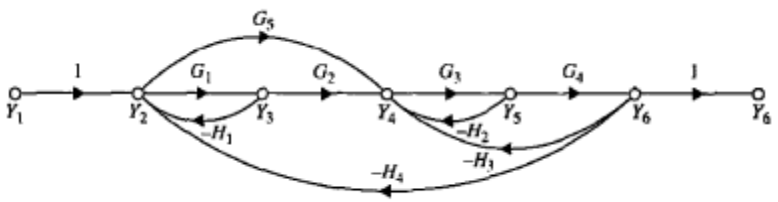

Fig Q2C

3A. Derive an expression for peak overshoot of a standard second order system, assuming the expression for unit step response. **2**

3B. Using Routh Hurwitz criteria determine the stability of the system, whose characteristic equation is given by $s^6+3s^5+8s^4+18s^3+20s^2+24s+16=0$. **3**

3C. The open loop transfer function of a feedback system is given by $G(s)H(s)=\frac{K}{s(s+1)(s+2)}$. Using Nyquist plot, find the range of K for stability. Comment on stability for K = 10 by Nyquist stability criteria. **5**

4A. Sketch the root locus for the open loop transfer function $G(s)=\frac{K}{s(s+3)(s+4)}$ **5**

4B. A unity feedback system has an open loop transfer function $G(s)=\frac{K(s+20)}{s(s+50)(s+100)}$ Find the value of K for Phase margin = 60°. Use Bode plot method. **5**

5A. Obtain the transfer function of the given Bode magnitude plot shown in Fig Q5A. **2**

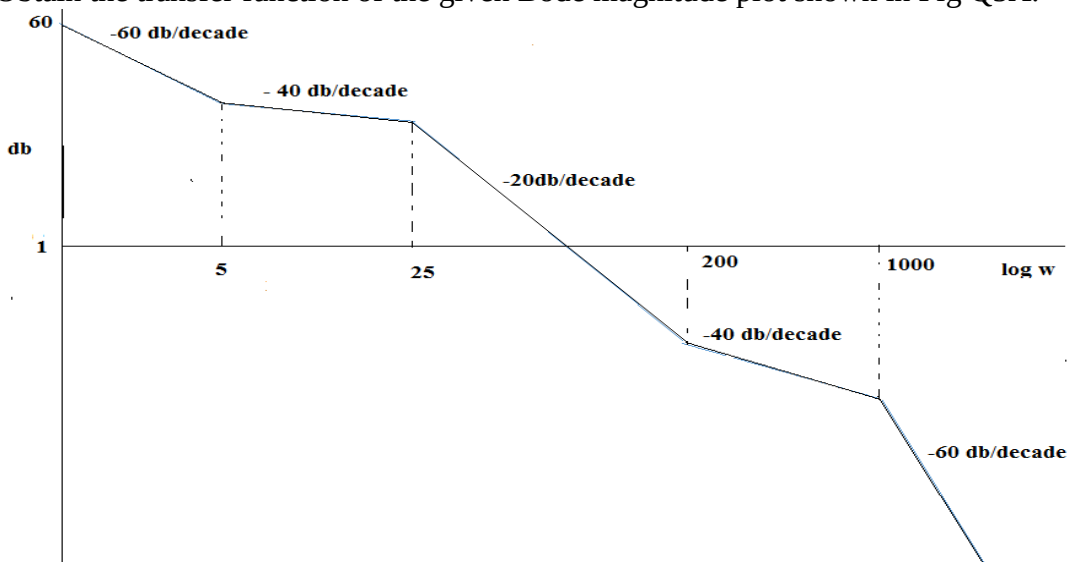

Fig Q5A

5B. Derive the transfer function for a lag network **3**

5C. Explain the procedure for designing a lead compensator in time domain. **5**

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