Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-VI Examination-Nov/Dec-2011

Subject code: 161905   **Date: 30/11/2011**
Subject Name: Control Engineering
Time: 10.30 am -1.00 pm   **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)** What are open loop control systems and closed loop control systems? Compare open loop control system with closed loop control system. Write down major advantages and disadvantages of open loop control systems. **07**

   (b) Define transfer function of a linear, time invariant, differential equation systems. Write down general mathematical model for the above system and general mathematical expression for its transfer fuction. **07**

Q.2 **(a)** `The transfer function is a property of a system itself, independent of the magnitude and nature of the input or driving function.' Explain this statement with suitable example. **07**

   (b) `If the transfer function of a system is known, the output or response can be studied for various forms of inputs with a view toward understanding the nature of the system.' Explain this statement with suitable example. **07**

OR

   (b) `If the transfer function of a system is unknown, it may be established experimentally by introducing known inputs and studying the output of the system. Once established, a transfer function gives a full description of the dynamic characteristics of the system, as distinct from its physical description.' Explain this statement with suitable example. **07**

Q.3 **(a)** Write down the major three steps to derive the transfer function of a given physical system. Derive expression for closed loop transfer function. **07**

   (b) Describe force-voltage analogy and force- current analogy as applied to electrical analogies for mechanical systems. **07**

OR

Q.3 **(a)** Describe an on-off control action type automatic industrial controller with differential gap. Write down equation of the system, and expression for the transfer function. Sketch block diagram of an on-off control action type automatic industrial controller with differential gap. **07**

   (b) Describe an proportional plus integral plus derivative control action type automatic industrial controller. Write down equation of the system, write down expression for the transfer function. **07**

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Q.4 **(a)** What are signal flow graphs? Define node, transmittance, branch, source, sink, path, loop, and loop gain. Write down important properties of signal flow graphs. Write down the rules for signal flow graphs reduction? Write down Mason's gain formula for signal flow graphs. Explain Mason's gain formula with the help of one example. **07**

(b) Write down the comparison between a pneumatic control system and hydraulic control system. Sketch a schematic diagram of a pneumatic nozzle flapper amplifier system and explain its working. Sketch characteristic curve relating nozzle back pressure and nozzle flapper distance for the above system. **07**

OR

Q.4 **(a)** Write down advantages and disadvantages of hydraulic systems. How proportional plus integral plus derivative control action is obtained in a hydraulic system? **07**

(b) Define delay time, rise time, peak time, maximum overshoot, and settling time as transient response specifications of a second order system. Derive mathematical expressions for rise time, peak time, maximum overshoot, and settling time for the above system. **07**

Q.5 **(a)** What is modern control theory? Compare modern control theory with conventional control theory. Define state, state variables, state vector, and state space. What is state space representation of systems? Write down general expressions for state space equation and output equation. **07**

(b) What is a programmable logic controller? Write down industrial applications of a programmable logic controller. What is a ladder logic diagram? How a ladder logic diagram is used for programming a programmable logic controller. **07**

OR

Q.5 **(a)** Define degree of membership, fuzzyfication and difuzzyfication, and rule based system. Describe crisp relations and fuzzy relations. **07**

(b) Describe control system for a thermal power plant with the help of a schematic diagram and a block diagram. **07**

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