Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

(A Constituent Institute of Manipal University)

Manipal – 576 104

SIXTH SEMESTER B.E (BIO-MED) DEGREE END-SEM EXAMINATIONS – MAY, 2008

SUBJECT: PHYSIOLOGICAL CONTROL SYSTEM (BME 312.2)

(REVISED CREDIT SYSTEM)

Monday, May 26, 2008: 9.00 am - 12.00 noon

TIME: 3 HOURS   **MAX. MARKS: 100**

Instructions to Candidates:

1. **Answer any FIVE full questions.**
2. **Draw labeled diagram wherever necessary**

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1. (a) For the mechanical system shown in fig Q1(a), draw the free body diagram and system differential equations. Also obtain analogous force to current and force to voltage electrical circuits and equations.   **10**

   (b) Find C/R using signal flow graph for the system shown in Fig Q1(b)   **10**

2. (a) Discuss on the process of heat production in the human body.   **10**

   (b) With the relevant diagram explain pupil control of human.   **10**

3. (a) A unity feed back control system has an open loop transfer function

   $$G(s) = \frac{K}{s(1 + 0.02s)(1 + 0.05s)}$$

   Sketch the root locus diagram of the system for 0<K<∞, and determine the marginal value of K for stability.   **12**

   (b) A unity feed back control system is characterized by the open loop transfer function

   $$G(s) = \frac{K(s+13)}{s(s+3)(s+7)}$$

   Using Routh criterion calculate the range of K for the system to be stable.   **8**

4 (a) Define gain margin and phase margin. A feed back control system has the open loop transfer function   **12**

$$GH(s) = \frac{10(s+1)}{s(1+0.5s)(1+0.02s)(1+0.1s)}$$

Construct the Bode plot, find gain margin, phase margin and discuss on the stability of the system.

(b) Obtain the time response of the first order system for unit step and unit ramp.   8

5. (a) A unity feed back system is characterized by the open loop transfer function   08

$$G(s) = \frac{1}{s(0.5s+1)(0.2s+1)}$$

Determine the steady state errors for unit step, unit ramp and unit acceleration inputs. Also determine the damping ratio and natural frequency of the dominant roots.

(b) With the block of mechanical section discuss on cardiovascular system.   12

6. (a) Discuss on the regulation of acid base and sodium ion concentration in the extra cellular fluid of the human body.   10

(b) Obtain the differential equation for the transfer of the substance between two compartments separated by a thin membrane.   10
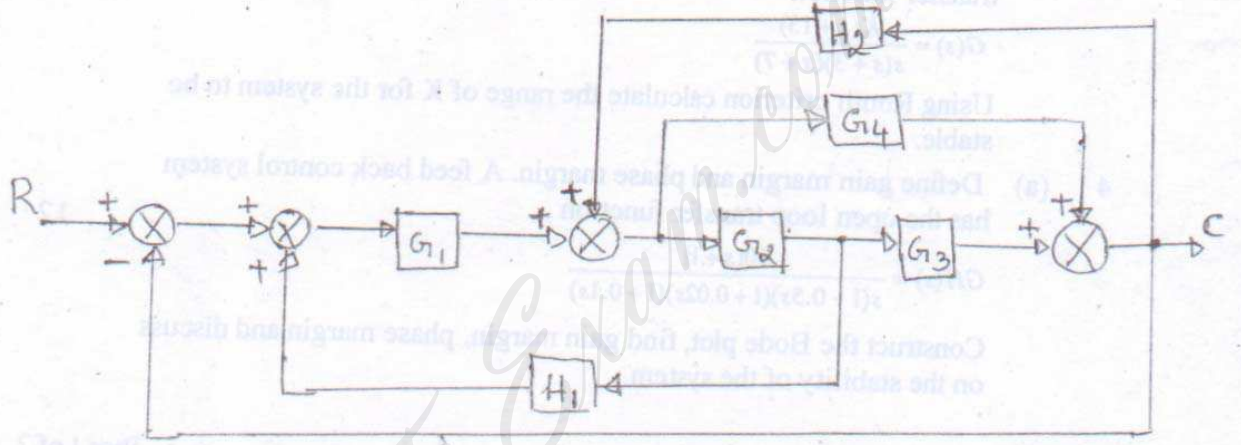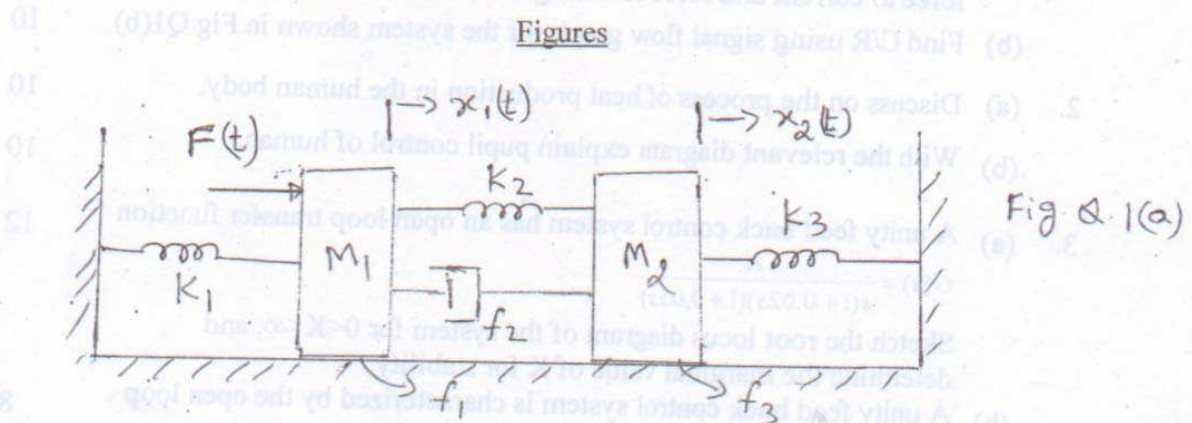
Figures

Fig Q. 1(a)

Fig Q. 1(b)