Code No. : 5215

FACULTY OF ENGINEERING
B.E. 4/4 (Prod.) I Semester (Main) Examination, December 2011
CONTROL SYSTEM THEORY

Time : 3 Hours] [Max. Marks : 75

Instructions : *Answer **all** questions from Part **A**. Answer **any five** questions from Part **B**.*

PART – A **(25 Marks)**

1. Why negative feedback is preferred in control systems ? **3**

2. Find the Inverse Laplace transform of **2**

$$F(s) = \frac{(s+3)}{(s+1)(s+2)}$$

3. For the system $G(s) = \frac{9}{s^2+2s+9}$, what is the steady state error for ramp input. **2**

4. The characteristic equation of a feedback system is given as $s^3 + 3ks^2 + (k+2)s + 4 = 0$. Determine the range of value of 'k' for the system to be stable. **3**

5. Why do we use logarithmic scale for frequency in Bode plot ? **2**

6. Sketch the polar plot of $G(s) = \frac{1}{s^2(1+s)(1+3s)}$. **3**

7. Why is a lag-compensator ? When it is preferred ? **3**

8. Why do we linearize non-linear systems ? **2**

9. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, find $\phi(t)$. **3**

10. What is the motivation behind finding the observability matrix for a system ? **2**

PART – B **(50 Marks)**

11. Derive the transfer function for an armature controlled DC servomotor. **10**

12. Draw the bode plot for a unity feedback control system whose transfer function is

$$G(s) = \frac{10(1+0.1s)}{s(1+0.5s)(1+0.25s)}$$

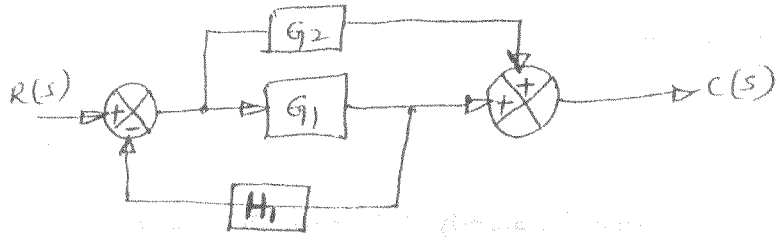
Also find the gain and phase margin. Comment on stability. **10**

13. The open-loop transfer function of a feedback system is

$$G(s)H(s) = \frac{K}{s\,(s+4)\,(s^2+4s+20)}$$

Draw the root-locus for $0 < K < \infty$. Find the value of 'K' for the system to be critically damped. Find gain margin for K = 26 dB. **10**

14. Represent the block diagram given below by SFG, and determine overall transmittance relating C(s), R(s) by Mason's formula **10**



15. Sketch the Nyquist plot and assess the stability of the closed-loop system, whose open-loop transfer functions is **10**

$$G(s)H(s) = \frac{Ks}{(s^2+2s+11)}$$

16. The transfer function of a control system is given by **10**

$$\frac{Y(s)}{U(s)} = \frac{s+2}{s^3+9s^2+26s+24}$$

Obtain the state-space model and check for observability.

17. Write short notes on : **10**

a) Sensitivity performance Indices

b) PID controller.
