BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI (RAJASTHAN)
First Semester 2008-2009

AAOC C321 Control Systems B
Quiz (Closed Book)

Date 20.11.2008 **Total Time: 50 min** **Max Marks: 40**

NOTE: Questions 1 to 8 of are 1 mark each and Questions 9 to 24 are of 2 marks each.

Name: **ID No:** **Sec. No.**

Q.1 "Pointing finger towards an object" is an example of a closed loop control system.

Q.2 System described by equation $\frac{d^2y(t)}{dt^2} + a_1^2 t\frac{dy(t)}{dt} + a_2 y(t) = u(t)$, where y is input and u is output is a Linear Time Variant system (Non linear/~~linear~~ and Time ~~variant~~/~~invariant~~).

Q.3 The Hydraulic system become sluggish at low temperatures (electrical/hydraulic).

Q.4 The Hydraulic system essentially requires the return lines (hydraulic/pneumatic).

Q.5 For a second order under damped system, the radial distance between a pole and the origin gives natural frequency of oscillation.

Q.6 Open loop transfer function of unity feedback control system is given by $G(S) = \frac{K}{s(s+1)}$

If the gain is increased to infinity, the damping ratio will tend to become zero.

Q.7 As compared to derivative error controller, the Integral error controller is used to meet the high accuracy requirements.

Q.8 The corner frequencies of $G(s) = \frac{(s+1)}{s(1+0.5s)}$ are 1 & 2 rad/sec.

Q.9 The addition of only a zero in the closed loop transfer function results in lesser rise time and lesser damping.

Q.10 For a unity negative feedback system, forward path gain is $\frac{30K}{s(s+5)}$. The magnitude of sensitivity S_K^T of the system, in case of open loop and closed loop to changes in K, (K = 0.2) at ω= 0.5 rad/s is 1 and 0.4 respectively.

Q.11 A 4-stack stepper motor has 45 numbers of teeth, assuming that stack rotor teeth aligns with its stator, the angular displacement between stacks of stator teeth is 2^0.

Q.12 The output of a system with transfer function $\frac{5}{(s+2)}$ for an input e^{-t} in time domain is $5(e^{-t} - e^{-2t})$

Q.13 The open loop poles of a unity negative feedback control system are at 0 and −1, when there is an increase of 22.5% in its natural frequency, the steady state error to unit ramp input is decreased effectively by 33.36% ≈ 33%.

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Q.14 The two phase servo motor develops a torque in accordance with the equation $T_m = K_1V_c - K_2\omega_m$ and its torque-speed characteristic is shown in Fig Q.14. The values of K_1 and K_2 are 0.1 Nm/V and 0.06 Nm/rad/sec respectively

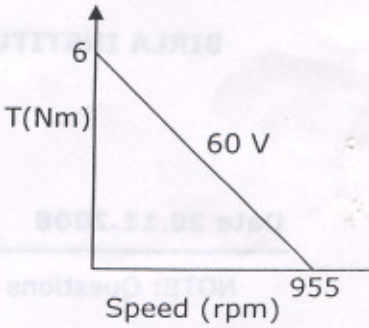


Fig. Q. 14

Q.15 The open loop transfer function of system 1 and system 2 are $K/(s+6)^4$ and $K/(s+6)^5$ respectively. System 2 is stable for more range of K.

Q.16 The signal flow graph of a system is shown in figure Q.16, transfer function C(s)/R(s) of the system is $\frac{1}{1+H_1+H_2+H_1H_2} = \frac{1}{(1+H_1)(1+H_2)}$

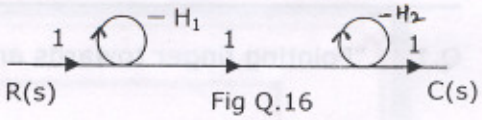


Fig Q.16

Q.17 The open loop transfer function of a unity negative feedback system is K/s^2. Root locus of the system will lie on Imaginary Axis.

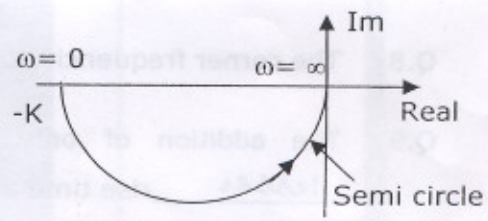
Q.18 Open loop transfer function of a system is K/(s+4). Time constant of the system in case of open loop and closed loop is 0.25 sec. and 1/6 ≈ .167 sec. respectively for K = 2.

Q.19 Control winding and reference windings of ac servomotor are displaced by 90° in phase and by 90° in space.

Q.20 The open loop transfer function of a system is $\frac{(s-3)}{(s+1)(s+3)}$. The gain margin and phase margin of the system is 0 db and 0 degree respectively.

Q.21 Polar plot of G(jω) is shown in Fig Q.21. The Transfer function G(s) is $\frac{K}{s \cdot \frac{1}{4} - 1}$ or $\frac{4K}{s-4}$

Q.22 The polar plot of $1/[s^2(s+1)(1+2s)]$ will lie in 1st & 2nd quadrant(s) and crosses imaginary axis at 0.629 ≈ 0.63. [Name the quadrant(s)]



∠G (jω) at ω= 4 is 225°
Fig Q.21

Q.23 The transfer function of a system is $\frac{K}{(s+3)}$. The error in Bode's asymptotic plot at ω = 6 rad/s is −1 db and ω = 3 rad/s is −3 db.

Q.24 Asymptotic Bode plot of a system is shown in Fig Q.24.The transfer function for which it is drawn, is _____.

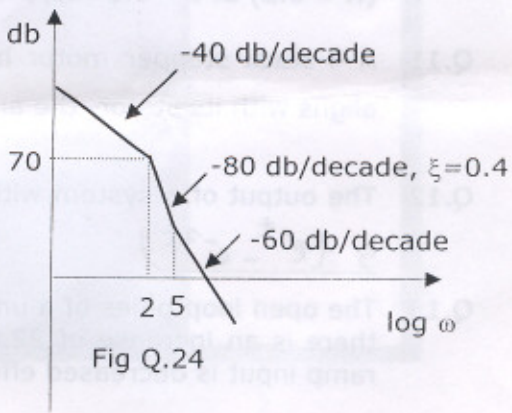


Fig Q.24

$\frac{0.8K(s+5)}{s^2(s^2+1.6s+4)}$ ① & $K = 12589$ or 12649 ①

~~10071~~ $\frac{10071 \text{ or } 10119\,(s+5)}{s^2(s^2+1.6s+4)}$