MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
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DEPARTMENT OF INSTRUMENTATION & CONTROL ENGINEERING

__ SEMESTER B.TECH. (ELECTRONICS & INSTRUMENTATION)

SEVENTH SEMESTER B. TECH (ELECTRONICS AND INSTRUMENTATION)

PROCTORED ONLINE END SEMESTER EXAMINATION Dec. 21/Jan. 22

SUBJECT: ROBUST CONTROL [ICE 4053] **TIME: 9.20 – 10.35 AM**

DATE: 30-12-2021 **MAX MARKS 20**

PART A

Q. No.	Questions
1.	Which is not an issue in Control System Design w.r.t robust control (1 Point) Model the resulting system to be controller Reduce the model mismatch ✓ Tune the controller online if necessary Analyze the resulting model: Determine its properties No correction required
2	**During multiplicative perturbation, the disk will be formed with center 1 and radi** (1 Point) Mod(W1) Mod(W2) ✓ Mod(W1/W2) Mod(W2/W1)
3.	

	For the given system transfer function, find the Parity Interlacing Property(PIP) is satisfie not $$P(s)=\frac{s^2-5s+2}{s^2-4s+3}$$
4.	6 $$\frac{\|W_1\|}{1-\|W_2\|}\Big\|$$ Under the Loopshaping technique, the above condition is true when W1 is less than one A) True B) False
5.	For the P Inverse unstable problem, to find the stable function, the T1 is given b (1 Point) ◯ T1=W1MN ◯ T1=W2YN ◯ T1=W1MY ✓ ◯ T1=W2MN

6.	Spectral factorization uses the all pass factor with property equated to (1 Point) ◯ 0.5 ◯ 1 ✓ ◯ 0.75 ◯ 0
7.	Kharitnov polynomials are given below, find the stability of the same (1 Point) $k_1(s) = 8 + 9.5s + 8s^2 + s^3$ ◯ *Stable* ✓ ◯ *Unstable*
8.	In the solution of modified problem, Q is identified satisfyin (1 Point) ◯ $Norm(U_4U_1 - U_4^{-1}U_1Q)_\infty < 1$ ◯ $Norm(U_4U_2 - U_4^{-1}U_1Q)_\infty < 1$ ◯ $Norm(U_4^{-1}U_1 - U_4^{-1}U_2Q)_\infty < 1$ ✓ ◯ $Norm(U_4U_1 - U_4^{-1}U_1^{-1}Q)_\infty < 1$
9.	The condition for weighting function under loopshaping for W1 and W2 at low frequenc (1 Point) ◯ $\|W_2\| > 1 > \|W_1\|$ ◯ $\|W_2\| < 1 < \|W_1\|$ ◯ $\|W_1\| > 1 > \|W_2\|$ ✓ ◯ $\|W_1\| < 1 < \|W_2\|$

10.	In controller parameterization the sensitivity transfer function is given by (1 Point) $S = 1 + PQ$ $S = 1 - \frac{P}{Q}$ $S = PQ$ $S = 1 - PQ$ ✓
11.	For robust performance condition, _______ is a condition (1 Point) $Norm(W_1T)_\infty < 1$ $Norm(W_2T)_\infty < \frac{1}{2}$ $Norm(W_1S)_\infty < \frac{1}{2}$ ✓ $Norm(W_2T)_\infty < 1$
12.	For a system with perturbation , the robust stability condition is given by (1 Point) $(P + Del.\, W_2)$ $norm(W_2T)_\infty$ $norm(W_2CS)_\infty$ ✓ $norm(W_2PS)_\infty$ $norm(W_2S)_\infty$

13.	From the basic control system, the output 'y' is given by (1 Point) ○ $P\,(d+u)$ ✓ ○ $P\,(y+n)$ ○ $P\,(r-v)$ ○ $C\,(r-v)$
14.	The plant, controller and filter transfer functions are given as below, The transfer function Y(s)/d(s) is (1 Point) $P\,(s) = \frac{1}{(s-1)(s-2)};\ C\,(s) = \frac{(s-1)}{s+2};\ F\,(s) = \frac{1}{(s+3)}$ ○ $\frac{(s+2)(s+3)}{s^4+s^3-8s^2-4s+13}$ ○ $\frac{(s+2)(s-1)}{s^4+s^3-7s^2-8s+13}$ ○ $\frac{(s-2)(s-2)}{s^4+s^3-8s^2-4s+13}$ ○ $\frac{(s+2)(s+3)}{s^4+s^3-7s^2-8s+13}$ ✓
15.	Find the internal stability of Y(s)/u(s)= -PCF/1+PCF (1 Point) $P\,(s) = \frac{1}{(s-1)(s-2)};\ C\,(s) = \frac{(s-1)}{s+2};\ F\,(s) = \frac{1}{(s+3)}$ ○ $M\arg inaly\ stable$ ○ $Stable$ ○ $Unstable$ ✓

16.	Using Bezout's Identity the complementary sensitivity function is given by (1 Point) ○ $T = M\,(Y + NQ)$ ○ $T = Q\,(Y + NM)$ ○ $T = Y\,(N + MQ)$ ○ $T = N\,(X + MQ)$ ✓
17.	In Linear Fractional Transformation(LFT), the final Z/W is (1 Point) ○ $F_l\,(p,k) = P_{12} + P_{11}K(I - P_{11}k)^{-1}P_{12}$ ○ $F_l\,(p,k) = P_{11} + P_{12}K(I - P_{22}k)^{-1}P_{12}$ ✓ ○ $F_l\,(p,k) = P_{22} + P_{21}K(I - P_{21}k)^{-1}P_{11}$ ○ $F_l\,(p,k) = P_{12} + P_{11}K\,(I - P_{11}k)\,P_{12}$
18.	During the design of robust controller, if Q(s) is improper, filter J(s) will be used. In J(s) th tuning parameter is (1 Point) ○ $Order\,'n'$ ○ $Time\ cons\tan t\,'T'$ ○ $Both\,'n'\ and\,'T'$ ✓ ○ $None\ of\ the\ above$

19.	Under modified problem, to reduce the model mismatch condition, U4 is defined as (1 Point) ○ $U4 = U3$ ○ $U4 = U3 - \frac{1}{2}$ ○ $U4 = U1 - U2$ ○ $U4 = \frac{1}{2} - U3$
20.	The nominal performance with a safety factor of 2 is given by (1 Point) ○ $norm\,(W_2S) < 1$ ○ $norm\,(W_1S) < 1$ ○ $norm\,(W_2S) < \frac{1}{2}$ ○ $norm\,(W_1S) < \frac{1}{2}$ ✓
21.	The uncertainty Del is calculated by (1 Point) ○ $\left[\frac{P_{perturbed}}{P_{no\ min\ al}}\right]$ ○ $\left[\frac{P_{perturbed}}{P_{no\ min\ al}} - 1\right]$ ✓ ○ $\left[1 - \frac{P_{perturbed}}{P_{no\ min\ al}}\right]$ ○ $\left[\frac{P_{no\ min\ al}}{P_{perturbed}} - 1\right]$

22.	In full information problem LFT frame work, the following is one of the assumption (1 Point) (A, B_2) is stabilizable ✓ (A, B_1) is stabilizable (C_2, A) is detectable (C_2, B) is detectable
23.	For a basic control system block, the transfer function of e/r is (1 Point) $\frac{PC}{1+PC}$ $\frac{1}{1+PC}$ ✓ $\frac{P}{1+PC}$ $\frac{C}{1+PC}$
25.	For finding the internal stability of the system which combinations are considered as outp (1 Point) r, d, n y, e, u ✓ r, e, n n, d, u
27.	Condition given below is too hard mathematical analysis, hence using ______________ it reduced to model mismatching problem (1 Point) $norm(\lvert W_1 S\rvert + \lvert W_2 T\rvert)_\infty < 1$ *Order reduction* *Spectral Factorization* ✓ *Robust design* *Disc problem analysis*

28.	Norms for signals have _______ properties (1 Point) ○ *Eight* ○ *Two* ○ *Four* ✓ ○ *Six*
29.	Infinity norm of a signal is a (1 Point) ○ *Supremum value of its absolute* ✓ ○ *Least value of its absolute* ○ *Always 1* ○ *Les than 1*
30.	The selection of weighting function W2 represents the (1 Point) ○ *Model mismatch* ○ *Uncertainty profile* ✓ ○ *W1 complement* ○ *Sensitivity function covering function*