Reg. No. | | | | | | | | | |

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

SEVENTH SEMESTER B.TECH. (INSTRUMENTATION AND CONTROL ENGG.)
END SEMESTER DEGREE EXAMINATIONS, DECEMBER - 2020

SUBJECT: Digital Control System [ICE 4022]

28-12-2020

TIME: 3 HOURS MAX. MARKS: 50

Instructions to candidates :*Answer ALL questions and missing data may be suitably assumed.*

1A. Derive open loop Pulse transfer function for the system shown in Fig.Q1A

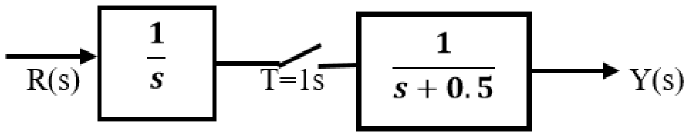

Fig. Q1A

1B. Solve for y(k) when unit step input is applied to the system shown in Fig. Q1A.

(6+4)

2A. Using Jury's test, analyse the stability of the characteristic polynomial given by
$P(z)= z^4 - 0.9 z^3 + 0.14 z^2 + 0.216 z + 0.032$

2B. Given $x(k+2) + 2 x(k+1) + 4 x(k)=0$ with $x(0) = -1$; $x(1) = 1$. Determine the stability of the system described by difference equation.

2C. The Break away and Break in points are _________ and _________, when root locus is plotted for the system $G(z) = \dfrac{k(z+0.52)}{(z-1)(z-0.135)}$.

(5+3+2)

3A. Determine the range of K for the closed loop system to be stable (using Routh's stability analysis), for the open loop system given by $G(s) = (ZOH * \dfrac{K}{(s+3)})$; with sampling frequency 1 Hz.

3B. Plot root locus of $\dfrac{K}{z(z-1)}$ and determine a) K at break away b) Critical value of K

(6+4)

4A. The open loop transfer function of a unity feedback control system is given by $G(z)=\dfrac{10}{z(z-1)}$ and T=1s. Determine the closed loop stability of the discrete time system using Bode plots.

4B. Design a lag compensator for system given in Q 4A so that overshoot of the desired output is 15% and Kv=50/s.

5+5

5A. Obtain step, ramp and parabolic error and corresponding gains of the system shown in Fig. Q5A.

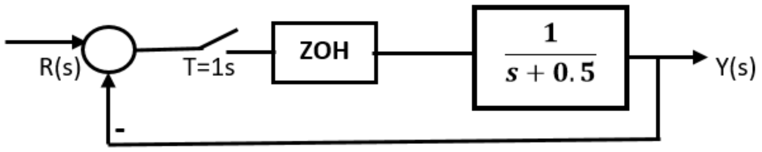

Fig. Q5A

5B. Obtain initial value and final value of $\dfrac{(z-2)z}{(z+2)(z-3)(z+4)}$.

(6+4)

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