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, NOVEMBER - 2019

SUBJECT: DIGITAL CONTROL SYSTEM [ICE 4022]

TIME: 3 HOURS MAX. MARKS: 50

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

1A. Plot the gain and phase characteristic of ZOH transfer function.

1B. Find the response of the following system y(k+2)-3y(k+1)+2y(k)=r(k); Where $r(k)=3^k$. with initial conditions y(0)=0 and y(1)=0.

1C. Derive the pulse transfer function of the system shown in Fig. Q1C.

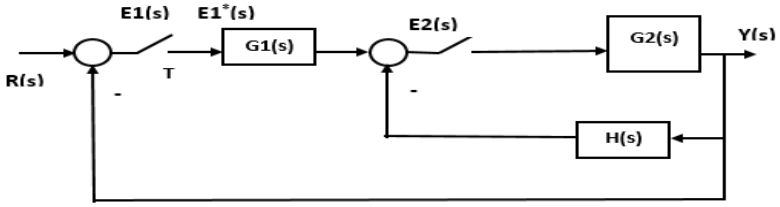

Fig. Q1C.

(3+3+4)

2A. Obtain initial value and final value of

$$X(z) = \frac{z^2(1-e^{-T})}{(z-1)(z-e^{-T})}$$

2B. Determine whether closed loop system given in Fig. Q2B is stable or not (by fundamentals of z plane).

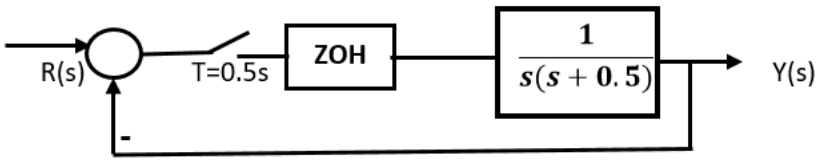

Fig. Q2B

2C. Obtain step, ramp and parabolic error and corresponding gains of the system shown in Fig. Q2C.

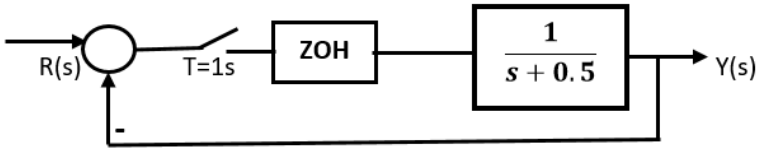

Fig. Q2C.

(2+3+5)

3A. Find range of K for which the closed loop system is stable using Jury's test if

$$G(z) = \frac{K}{z(z-1)} \; ; \quad T = 2s$$

3B. Determine whether the closed loop system is stable or not using Routh's stability criteria if characteristic equation is $\mathbf{P(Z) = Z^3 - 1.7Z^2 - Z + 0.8 = 0}$.

3C. Plot root locus if open loop system is given as

$\boldsymbol{G(z) = \frac{K(z+0.52)}{(z-1)(z-0.135)}}$. Find the range of K and corresponding 'Z' for which the closed loop system is stable. Also find K at break away and break in points.

(3+3+4)

4A. The function f(t) after passing through the sampler is represented in discrete domain as _____.

4B. Plot Bode magnitude and phase plots of

$G(z) = \frac{0.368z + 0.264}{(z-1)(z-0.368)}$ and analyse its closed loop stability. (T=1s)

4C. Design a lead compensator for system given in (Q. 4B) using bode plot approach so that damping coefficient is 0.7

(1+5+4)

5A. Explain the mapping between S plane and Z plane with necessary diagrams.

5B. Derive open loop step response of the Fig. Q5B.

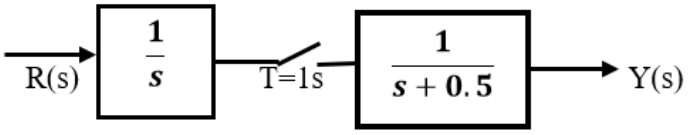

Fig. Q5B

5C. Draw the Nyquist plot of

$G(Z) = \frac{0.095z}{(z-1)(z-0.9)}$ and determine its closed loop stability.

(2+3+5)

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