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, JANUARY - 2021

SUBJECT: Digital Control System [ICE 4022]

29-01-2021

TIME: 3 HOURS MAX. MARKS: 50

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

1A. Determine the type of the given unity feedback system, $G(z)=\dfrac{0.239K(z+0.876)}{(z-1)(z-0.2644)}$

1B. Derive the pulse transfer function of the system given in Fig.Q.1B

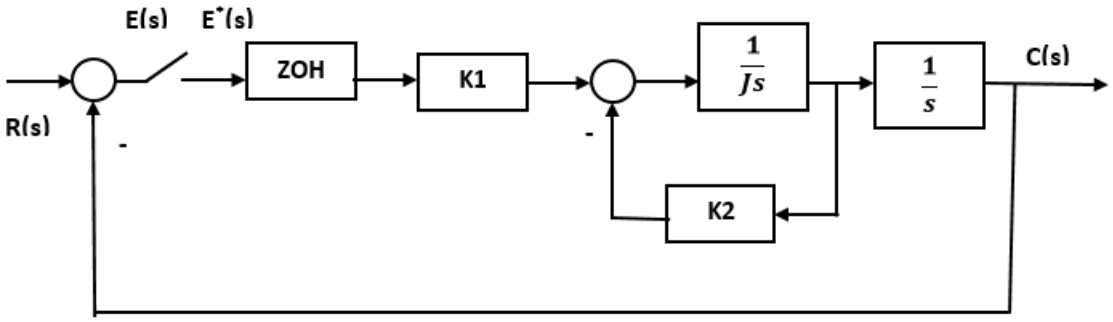

Fig Q 1B

1C. Solve the difference equation given as $x(k+2)-1.5x(k+1)+0.5x(k)=1(k)$

(3+3+4)

2A. Derive closed loop impulse response of the Fig. Q2A.

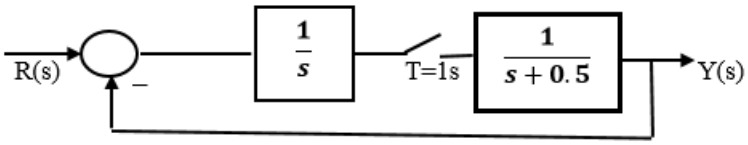

Fig. Q2A

2B. Apply Jury's test and determine the closed loop stability of the given block.

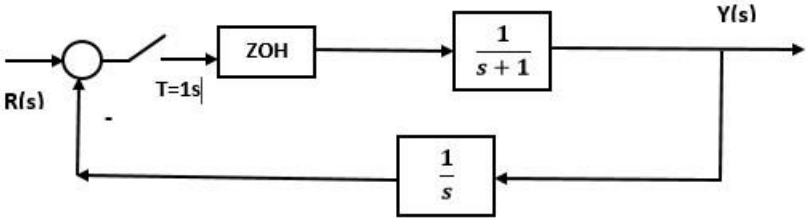

Fig. Q2B

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2C. Given the open loop pulse transfer function $G(z)=\frac{0.011K(z+0.847)}{(z-1)(z-0.607)}$ Find $K_{critical}$ using Routh's stability criteria.

(2+4+4)

3A Plot root locus of $G(z)=\frac{K(z+1)}{(z-1)(z-0.242)}$ by finding Angle of asymptotes, break away and break in points. Also find K at break away /break in points and at z=-1.

3B Find the frequency of sustained oscillation and gain at that point of the closed loop system given in Q.3A

6+4

4A With neat diagram describe the mapping between S domain and Z domain.

4B Derive the region of convergence for the function $f(k)=k;k\geq 0$ $f(k)=0;k<0$

4C Design a lead compensator for system given in Q3A to meet design specification OS 16% and rise time 2s.

2+2+6

5A Plot Bode diagrams of $G(z)=\frac{10}{z(z+2)}$ T=1s. Measure gain margin and phase margin from the plot and comment on closed loop stability of the system.

5B Formulate recursive discrete time PID control law by approximating the derivative by forward difference and integral by forward rectangular integration technique.

6+4

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