

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY
End Term Examination, December 2022
B. Tech.(all), Semester III

Roll No.....

Course Code : ES1106

Time: 2.5 hours Max. Marks: 30

Course Name: Computational Engineering Analysis-I

Instructions to students:

1. Do not write anything other than your roll number on the question paper.
 2. All questions are compulsory.
-

- Q 1. (a) Check the analyticity of the function $f(z) = z\bar{z}$. 1.0
(LO-3)
- (b) Determine the singularities of $f(z) = \frac{z}{z^2 - 3z + 2}$. 1.0
(LO-3)
- (c) Write the Taylor's series expansion of $f(z) = \frac{1}{3-2z}$ about $z = 1$ and indicate the region of convergence. 2.0
(LO-3)
- (d) Check whether the following function is harmonic or not. If harmonic, find its harmonic conjugate: 2.0
(LO-3)
- $u(x, y) = e^x(x \cos y - y \sin y)$
-

- Q 2. (a) Derive the following result: 1.0
(LO-4)
- $L[\cosh(ax)](s) = \frac{s}{s^2 - a^2}, s > a \geq 0.$
- (b) Find the Laplace transform of the following functions: 2.0
(LO-4)
- i. $f(t) = e^t t \sin t$
- ii. $f(t) = e^t + \sqrt{t} + e^e.$
- (c) Find the inverse Laplace transform of any one of the following functions: 2.0
(LO-4)

$$F(s) = \frac{2s + 12}{s^2 + 6s + 13}$$

OR

$$F(s) = \frac{5s^2 - 7s + 17}{(s - 1)(s^2 + 4)}$$

- (d) Write the following function in term of unit step function and then find the Laplace Transform of the function using appropriate property: 1.0
(LO-4)

$$f(x) = \begin{cases} 1, & 0 < x < 3 \\ 3, & x > 3 \end{cases}$$

- (e) Use the method of Laplace transform to solve the following second-order linear initial-value problem: 3.0
(LO-4)

$$y'' + 7y' + 10y = 4e^{-3t}, \quad y(0) = 0 \text{ and } y'(0) = -1$$

Q 3. Synthesize below function in foster-I and Cauer-II

[2.5+2.5+01]

$$Z(s) = \frac{(s+1)(s+4)}{s(s+2)}$$

LO-5,6

Also predict the stability using pole zero plot on the complex plane.

OR

Synthesize below function in foster-II and Cauer-I

[2.5+2.5+01]

$$Z(s) = \frac{(s+1)(s+4)}{s(s+2)}$$

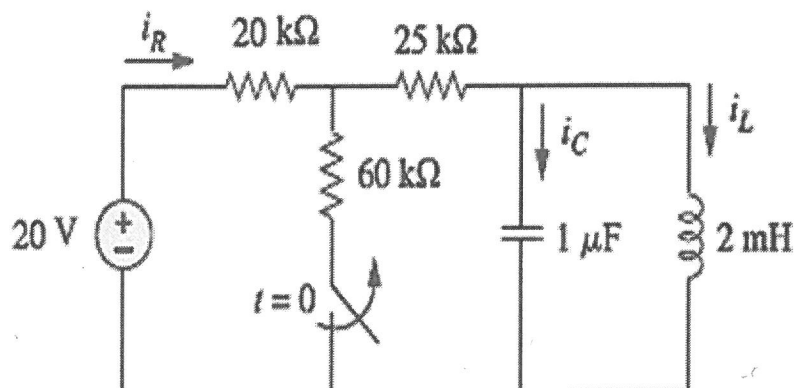
LO-5,6

Also predict the stability using pole zero plot on the complex plane.

Q 4. (a) Below circuit has attained steady state condition and at $t=0$ switch S was opened.

[04]

LO-4



Determine the below particulars

- (a) $i_L(0^-)$ (b) $v_C(0^-)$ (c) $i_L(t)$, (d) $i_C(t)$

Q 5. (a) A governing equation for industrial controller is represented by

[03]

LO-4, 5

$$\frac{d^2x}{dt^2} - 4x = e^{-t}$$

Assume all zero initial condition. Use Laplace transform to obtain the pole zero diagram and predict the stability.

(b) Check whether the following polynomial is Hurwitz or not

[02]

LO-6

(a) $P(S) = S^4 + S^3 + 2S^2 + 3S + 2$

(b) $P(S) = 2S^4 + 12S^2 + 16$