JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2025

B.Tech-V Semester (ECE)

COURSE CODE (CREDITS):18B1WEC534 MAX. MARKS: 35

COURSE NAME: NETWORK ANALYSIS AND SYNTHESIS

COURSE INSTRUCTORS: Dr Rajiv Kumar MAX. TIME: 2 Hours

Note: *(a) All SIX questions are compulsory.*

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Students are allowed to use non-programmable scientific calculator

Q.No	Question	CO	Marks
Q1	A) What do you mean by Hurwitz polynomials? What are the necessary conditions for a polynomial to be Hurwitz? B) Using the Routh–Hurwitz criterion, check whether the following polynomials are Hurwitz or not: 1. $P_1(s)= s^3-2s^2+3s+1$ 2. $P_2(s)=s^3+6s^2+11s+6$ 3. $P_3(s)=2s^4+8s^3+12s^2+10s+3$	CO-4	3+3=6
Q2	Derive the conditions under which following biquadratic function is positive real (PR). $$F(s) = \frac{s^2 + a_1 s + a_0}{s^2 + b_1 s + b_0}$$ Show all necessary steps and state the final PR conditions in terms of the coefficients.	CO-3	5
Q3	In the following two cases, synthesize a passive R–L–C network that realizes the impedances: $Z_1(s) = \frac{s^2 + 2s + 6}{s(s+3)}$, $Z_2(s) = \frac{6s^3 + 3s^2 + 3s + 1}{6s^3 + 3s}$ (a) Prove that both impedances are positive-real. (b) Draw the final circuit and give the numerical element values.	CO-1	3+3=6

Q4	A) What is meant by an L–C driving-point impedance? Explain with an example. How do the properties of L–C driving-point impedances differ from those of R–L or R–C impedances? B) Synthesize the L–C driving-point impedance $$Z(s) = \frac{s^4 + 42s^2 + 4s}{s^5 + 18s^3 + 48s}$$	CO-3	3+3=6
Q5	A) What is a state transition matrix (STM)? State and explain any four important properties of the STM, Φ(t). B) Define Φ(t) for a linear time-invariant system with following 3×3 state matrix: $$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}$$	CO-3	3+3=6
Q6	A) Define the A-parameters of a two-port network and explain their physical significance. B) You are given the open-circuit impedance (Z) matrix of a two-port network: $$Z = \begin{bmatrix} Z_{11} & Z_{12} \\ Z_{21} & Z_{22} \end{bmatrix}$$ Determine the condition whether the network is symmetrical or reciprocal.	CO-2	3+3=6