

THAPAR INSTITUTE OF ENGINEERING & TECHNOLOGY, PATIALA  
END SEMESTER EXAMINATION

145

Subject: EI-004, Elements and Analysis of Instrumentation Systems (Third year B.E.(EIC))

Course Faculty: Dr. Yaduvir Singh

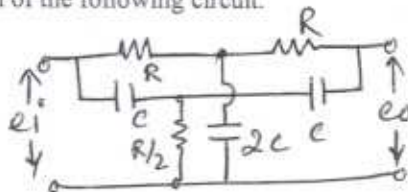
Maxm. Time: Three Hours

Maxm. Marks: 36

Note: Attempt any six (06) questions. All questions carry equal marks. Support your answers with the practical cases, characteristic plots etc., if applicable. Make suitable assumptions, if required.

Q. No. 1:

Explain concept of stiffness. What are the conditions for maximum power transfer in an instrumentation? Obtain transfer function of the following circuit.



Q. No. 2:

What is meant by dynamic response? Obtain (derive and plot) unit step input response of a generalized second order measurement device.

Q. No. 3:

Explain the concept of dead time. A first order measurement device has following open loop transfer function.

$$G(s) = \frac{e^{-5s}}{(1+5s)}$$

Derive and plot its open loop time response for the unit step input.

Q. No. 4:

Write technical notes on the following. Support your answer with neat sketches and relevant details.

- (a) LED and LCD
- (b) Fiber Optical Sensor

Q. No. 5:

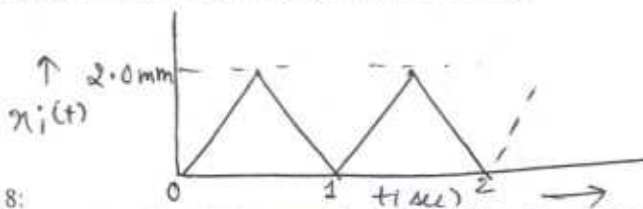
What are discrete data systems? Mention an example of it with suitable sketches. Obtain Z-transform of analog signal  $f(t + nt)$ .

Q. No. 6:

Explain narrow band pass filter (op-amp based) using multiple feedback. Derive and obtain its transfer function.

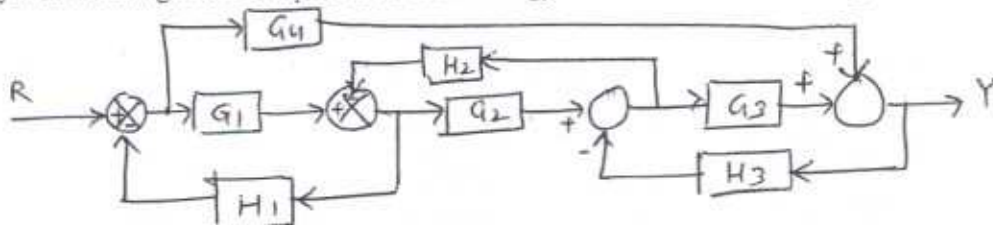
Q. No. 7:

Write a Fourier series approximation for the function as given below, such that the error is zero at  $t = 0, T/3, T/2, 2T/3$  and  $T$ . Draw the approximate function thus obtained. If this function is used as an input signal to a second order instrument with  $\omega_n = 10$  rad/sec,  $\xi = 0.3$ ,  $K = 5$  mV/mm, find the steady state output of the instrument. (All notations carry standard meaning.)



Q. No. 8:

What is system modeling? Give complete table of f-i analogy. Obtain Y/R of the following.



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