PAPER ID-310428

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM VII) THEORY EXAMINATION 2024-25
FILTER DESIGN

TIME: 3 HRS **M.MARKS: 100**

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

Q no.	Question	CO	Level
a.	Define the term Analog Filter.	1	1
b.	Differentiate between circuit simulation and circuit modeling.	1	2
c.	Define bilinear transfer function.	2	1
d.	Define Bode plot.	2	1
e.	Define design parameters for a second-order low-pass filter	3	1
f.	Illustrate the function of integrators in second-order filter design.	3	2
g.	Define Butterworth pole location for a second-order filter.	4	1
h.	Define the Chebyshev polynomial.	5	1
i.	Define voltage feed-forward.	4	1
j.	Define Cauer filters.	5	1

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 20**

a.	Apply the concept of feedback to design a voltage follower circuit.	1	3
b.	Implement a first-order active filter using an operational amplifier.	2	3
c.	Design a second-order low-pass filter for a specified cutoff frequency.	3	3
d.	Demonstrate how cascade design is used in filter implementation by outlining the steps to create a multi-stage Butterworth filter.	4	3
e.	Analyze the characteristics of an inverse Chebyshev filter and explain how it differs from a standard Chebyshev filter.	5	4

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

a.	Analyse the impact of scaling on circuit parameters such as resistance and capacitance. Examine the differences between descriptive and functional terminology in filter design.	1	4
b.	Analyse the effect of resistive feedback on op-amp performance. Explain the block diagram of an operational amplifier with feedback.	1	4

4. Attempt any *one* part of the following: **10 x 1 = 10**

a.	Explain the working of non-inverting operational amplifiers. Also give its applications	2	3
b.	Explain with suitable example; how you can convert a low pass filter into a band stop filter using frequency transformation?	2	3

5. Attempt any *one* part of the following: **10 x 1 = 10**

a.	Analyze the effect of increasing the quality factor Q on the frequency response of a second-order band-pass circuit. How does this influence the bandwidth and peak gain?	3	4

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b.	For a biquad circuit designed as a notch filter, analyze the placement of poles and zeros in the s-plane and their impact on the frequency response	3	4

6. Attempt any *one* part of the following: 10 x 1 = 10

a.	Explain the frequency warping in Bilinear transformation	4	3
b.	Apply your understanding of filters to describe how arbitrary transmission zeros are implemented and their practical significance in filter design.	4	3

7. Attempt any *one* part of the following: 10 x 1 = 10

a.	Analyze the trade-offs between using a maximally flat (Butterworth) response and an equal-ripple (Chebyshev Type I) response in terms of filter design for a high-precision audio application.	5	4
b.	Given a set of filter specifications, analyze the design process for a Cauer filter. How does the interaction of passband ripple, stopband attenuation, and pole-zero placement determine the overall response?	5	4