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# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## January / February 2025 Semester End Main Examinations

**Programme: B.E.** **Semester: III**
**Branch: Electronics and Telecommunication Engineering** **Duration: 3 hrs.**
**Course Code: 22ET3PCSSA** **Max Marks: 100**
**Course: Signals And Systems: Analog**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.



| | | UNIT - I | CO | PO | Marks |
|---|---|---|---|---|---|
| 1 | a) | Define even and odd signals with necessary equations and sketch the even and odd components of a unit step signal | CO1 | | **07** |
| | b) | A signal is given by $x(t) = \begin{cases} 1; 0 \le t \le 1 \\ 0; otherwise \end{cases}$. Determine whether the signal is energy signal or power signal. Hence find the energy or power. | CO2 | PO1 | **07** |
| | c) | A signal is given by $x(t) = u(t) - u(t-1)$. It is applied through a differentiator. sketch the signals before differentiator and after differentiator. | CO2 | PO1 | **06** |
| | | **OR** | | | |
| 2 | a) | Consider the signal given below:<br>x(t) = 5{u(t+2) -2u(t) + u(t-2)}<br>Sketch the following:<br>(i) x(t)<br>(ii) x(t-4)<br>(iii) derivative of x(t)<br>(iv) integral of x(t)<br>Compute the Energy of the signal<br>Compute the Power of the signal | CO2 | PO1 | **10** |
| | b) | Consider the signal given below:<br>x(t) = 5{u(t+2) -2u(t) + u(t-2)}<br>y(t) = 10{u(t) – u(t-4)}<br>Compute and sketch the convolution of the signals | CO2 | PO1 | **10** |
| | | **UNIT - II** | | | |
| 3 | a) | Starting from the expression of convolution integral derive the expression for step response | CO1 | | **08** |
| | b) | convolute the following signals<br>$x_1(t) = \cos \pi t[u(t+1) - u(t-3)]$<br>$x_2(t) = u(t)$ | CO2 | PO1 | **12** |

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| | | | **OR** | | | |
| | 4 | a) | Prove that $\big(x(t) * h_1(t)\big) * h_2(t) = x(t) * (h_1(t) * h_2(t))$ for convolution integral. Where x(t) is the input signal and h(t) are the impulse responses of the systems. | *CO1* | | **08** |
| | | b) | convolute the following signals<br>$e^{-2t}u(t) * u(t-1)$ | *CO2* | *PO1* | **12** |
| | | | **UNIT - III** | | | |
| | 5 | a) | Find the Fourier transform of x(t)=cos$\omega_0$t . Also sketch the magnitude and phase spectrum | *CO2* | *PO1* | **10** |
| | | b) | State and prove the following properties for Fourier Transform<br>(i) Parsevals theorem<br>(ii) Time shift property | *CO1* | | **10** |
| | | | **OR** | | | |
| | 6 | a) | Find the Fourier transform of a unit step function | *CO1* | | **06** |
| | | b) | State and prove any two properties of Fourier series | *CO1* | | **06** |
| | | c) | Evaluate Fourier Series coefficients and draw the spectrum for<br>$x(t) = sin\,4\pi t + cos\,2\pi t$ | *CO2* | *PO1* | **08** |
| | | | **UNIT - IV** | | | |
| | 7 | a) | Draw the DF-I and DF-II structures for the following system<br>$\frac{d^3}{dt^3}y(t) + 2\frac{d}{dt}y(t) + 3y(t) = x(t) + 3\frac{d}{dt}x(t)$ | *CO2* | *PO1* | **10** |
| | | b) | Draw the circuit for RL first order low pass filter and find the following.<br>(i) Transfer Function<br>(ii) Impulse response<br>(iii) Frequency response<br>(iv) Pole-Zero plot | *CO2* | *PO1* | **10** |
| | | | **OR** | | | |
| | 8 | a) | Consider the system transfer function given below:<br>$H(s) = \frac{(s+1)}{(s-2)(s-3)}$<br>(i) Sketch the pole-plot<br>(ii) Obtain and sketch the impulse response<br>(iii) Obtain the system differential equation<br>(iv) Sketch the magnitude response and classify the system as Low-Pass/ High-Pass | *CO2* | *PO2* | **10** |
| | | b) | Consider the cascade of two stages of RC circuit (Low-Pass configuration). Obtain:<br>(i) The system transfer function<br>(ii) System impulse response | *CO2* | *PO2* | **10** |
| | | | **UNIT - V** | | | |
| | 9 | a) | Describe analog to analog frequency transformations with | *CO3* | *PO3* | **06** |

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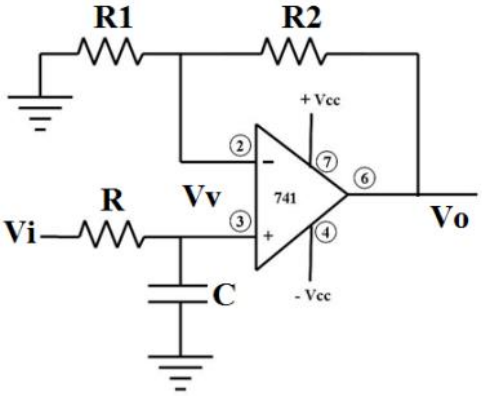
| | | | relevant equations | | | |
| | | b) | Derive the expression for finding the order of Butterworth filter | *CO1* | | **08** |
| | | c) | Describe the procedure of analog filter design using Butterworth filter | | | **06** |
| | | | **OR** | | | |
| | 10 | a) | Explain salient features of analog Butterworth filters | *CO1* | | **05** |
| | | b) | Derive the transfer function of the first order circuit given below:   | *CO1* | | **05** |
| | | c) | Design and implement the second order analog High-Pass Butterworth filter to have gain of 4, cut-off frequency of 5KHz. Give the pole-plot and the transfer function of the designed filter. | *CO1* | | **10** |

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