

Reg No :

Name :

**MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM**

(Govt. Aided Autonomous Institution)

Fourth Semester B.Tech. Degree Examination, May, 2026

Course Code: B24EE2T05

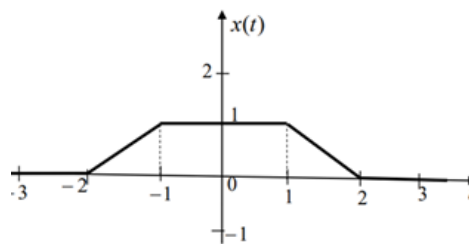
Course Name: SIGNALS AND SYSTEMS

Max. Marks: 100

Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)**Answer all questions**

1. Find the convolution of $tu(t)$ with itself.
2. Plot $x(2t + 3)$ for the given signal.



3. A signal $x(t) = 5\sin(t)$ is given as input to a half wave rectifier. Evaluate the DC component of the rectified signal.
4. What are the conditions to be satisfied for the existence of Fourier transform of function?
5. State Mason's gain formula and explain the terms involved.
6. Determine the impulse response of the system having transfer function, $H(s) = \frac{s}{(s-2)(s+3)}$.
7. An analog signal expressed by the equation, $x(t) = 2\cos(400\pi t) + 6\cos(600\pi t)$ is sampled with a sampling frequency 800Hz. Write the resultant discrete signal.
8. Find the frequency response of the causal system $y(n) = \frac{1}{2}x(n) + x(n-1) + \frac{1}{2}x(n-2)$.
9. A causal system is represented by $H(Z) = \frac{Z+2}{2Z^2-3Z+4}$. Find the difference equation and frequency response of the system.
10. State and prove Linearity property of Z-Transform.

PART - B: 70 Marks (5 Qns x 14 Marks)

Answer any One full question from each module.

Module 1

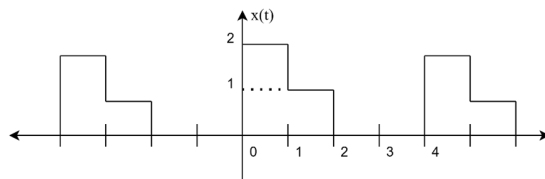
11. a. What are periodic signals? Derive the condition for the sum of two periodic signals to be periodic. (5 Marks)
- b. Check if the following signals are periodic or not. If periodic find the fundamental time period. (9 Marks)
- $2.5 \cos 20\pi t + \sin 10\pi t$
 - $10\cos 2t + 15\sin \sqrt{3}t$
 - $4 \sin \frac{2\pi n}{3} + 4\cos \frac{2\pi n}{5}$

OR

12. a. Find whether the following systems are stable or not. (9 Marks)
- $h[n] = u[n]$
 - $h(t) = \frac{1}{RC} e^{-t/RC} u(t)$
 - $h[n] = 8^n; 0 < n < 10$
- b. What are causal systems? Find if the signal $y(t) = x(t^2)$ is causal or non-causal. (5 Marks)

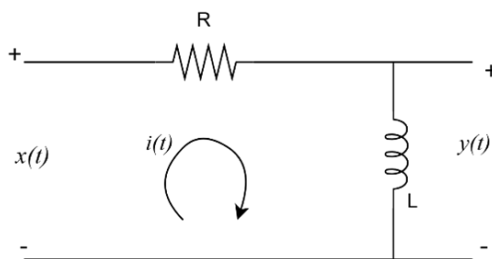
Module 2

13. Compute the exponential Fourier series of the following signal. Also find the coefficient corresponding to 3rd harmonic.



OR

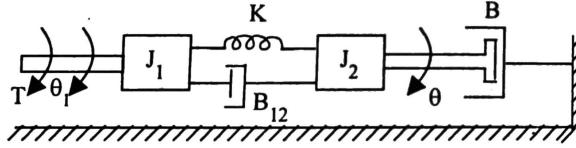
14. a. Find the frequency response of the RL network shown in Figure using Fourier transform. Also find the impulse response of the circuit. (8 Marks)



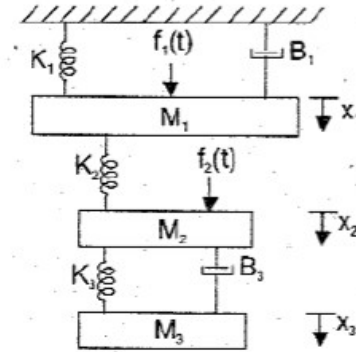
- b. Using Fourier transform, find the differential equation describing the system having impulse response $h(t) = [3e^{-3t} - 2e^{-2t}]u(t)$. (6 Marks)

Module 3

15. a. Determine the transfer function $\theta(s)/T(s)$ of the system shown in figure. (8 Marks)

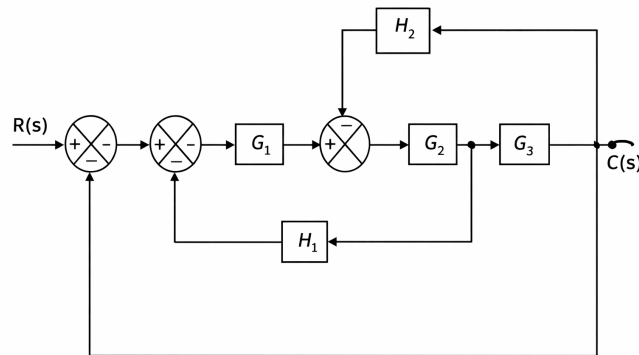


- b. Write the differential equations governing the mechanical system shown in figure. (6 Marks)



OR

16. a. Determine the overall transfer function using block diagram reduction for system shown in Fig. (8 Marks)



- b. List advantages and disadvantages of open-loop control systems. (6 Marks)

Module 4

17. a. State and prove Linearity property of DTFT. (4 Marks)
- b. Find the DTFT of the following, (10 Marks)
- $x(n) = a^{|n|}$
 - $x(n) = -a^n u(-n-1)$
 - $x(n) = \{1, -2, 2, 3\}$

OR

18. a. Let $x(n)$ be a periodic sequence with period 'N' and Fourier series coefficients C_k . (6 Marks)
Derive the Fourier series coefficient of $x(n-n_0)$.
- b. Determine the exponential Fourier series representation of the discrete time signal, (8 Marks)
 $x(n) = 4 \cos\left(\frac{\pi n}{2}\right)$.

Module 5

19. a. Compare Laplace transform and Z transform. (6 Marks)
- b. Find the Z-transform and ROC of the following signals, (8 Marks)
- i. $x(n) = a^n u(n) - b^n u(-n-1)$
- ii. $x(n) = (2/3)^n u(n) + (-1/2)^n u(n)$

OR

20. Find the direct form-I and direct form-II realizations of a discrete-time system represented by the transfer function, $H(Z) = \frac{3Z^3 - 5Z^2 + 9Z - 3}{\left[Z - \left(\frac{1}{2}\right)\right]\left[Z^2 - Z + \left(\frac{1}{3}\right)\right]}$.
