(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : Roll No.

B. Tech.

(Semester-III) Odd Semester Carry Over Theory Examination, 2012-13

BASIC SYSTEM ANALYSIS

Time : 3 Hours] *[Total Marks : 100*

Note : Attempt questions from each Section as per instructions.

Section-A

Attempt *all* parts of this question. Each part carries 2 marks. 2×10=20

1. (a) Write the mathematical expression for the waveform shown in Fig (1).

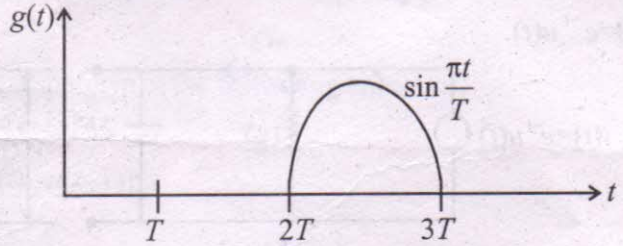


Fig. 1

(b) Write the mathematical expression for the waveform shown in Fig(2).

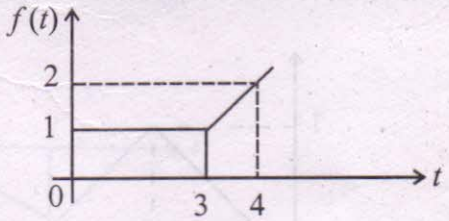


Fig. (2)

(c) Define Inertia torque and Damping force.

(d) State the D' Alemberts' principle.

(e) Define Time and Frequency scaling.

(f) What are CAUSAL functions ?

(g) Define convolution in Time-Domain.

(h) Determine the Laplace Transform of the function :

$$(1-e^{2t})u(t).$$

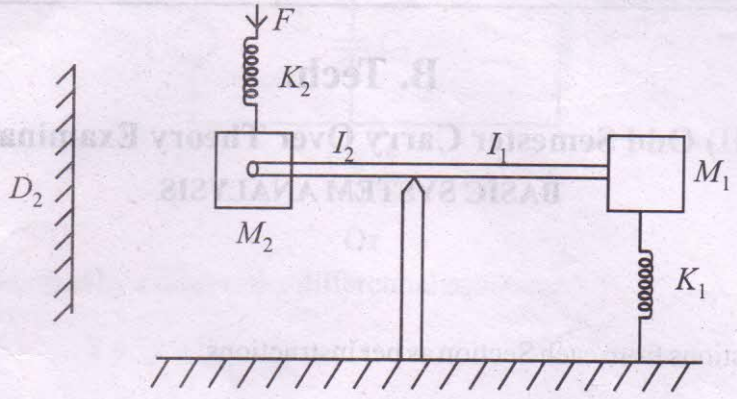
(i) List the advantages of the state-variable formulation.

(j) Define convolution and shift-in time properties of z-transform.

Section-B

Attempt any three parts of this question. Each part carries 10 marks. 10×3=30

(a) For the mechanical system shown drawn, Fig-3, the electrical analog using *f–v* and *f–i* analysis.



(b) Determine the output voltage across the capacitor fig-4, if the excitation is a current source $i(t)=e^{-t}u(t)$.

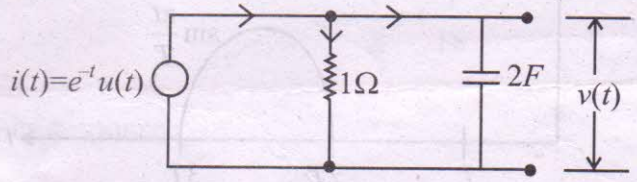


Fig. 4

(c) Determine the Laplace transform of the triangle shown in Fig. 5.

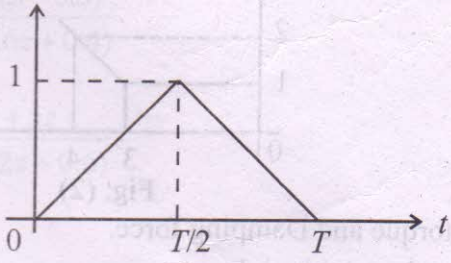


Fig. 5

(d) List all the properties of state transition matrix.

(e) Determine the inverse of the following *z*-transform :

$$x(z)=\frac{2z}{z^2+1}+\frac{2z}{z^2-1}.$$

Attempt all question of this Section. Each question carries 10 marks. 10×5=50

3. (i) The first derivative of a functions is shown in Fig. (6) by the impulse train. Draw th function $f(t)$.

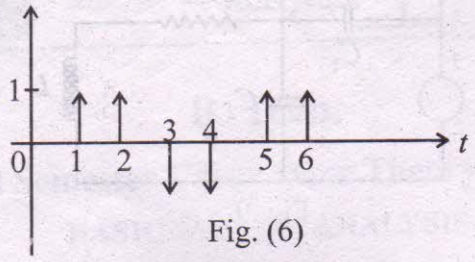


Fig. (6)

(ii) Explain the characteristics of various types of systems.

Or

Explain F–V and F–I analogy to describe the mechanical and electrical system.

Determine the function $f(t)$ if the Fourier Transform of the function is :

$$F(j\omega) = \begin{cases} A.e^{j\pi/2} & -\omega_0 < \omega < 0 \\ A.e^{-j\pi/2} & 0 < \omega < \omega_0 \end{cases}$$

Or

Determine the Fourier transform of the following signals :

(i) $f(t) = a[u(t) - u(t-1)]$

(ii) $f(t) = A\,e^{-\alpha t}[u(t) - u(t-1)]$.

5. Determine the Laplace transform of the function shown in Fig. 7.

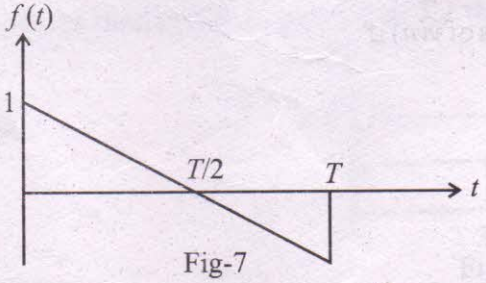


Fig-7

Or

Determine the voltage across the parallel combination in the given circuit Fig. 8 when it connected across a current source $I_0\,\delta(t)$.

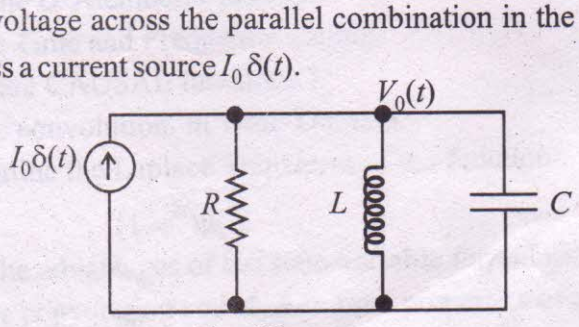


Fig. (8)

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6. For the network shown in Fig. 9, obtain the state equation using topological method.

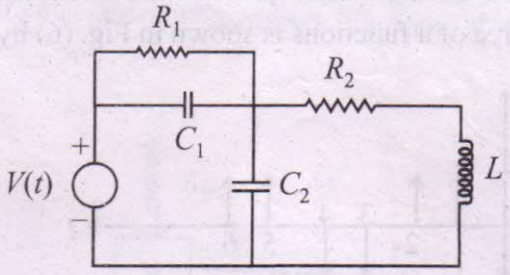

Fig. 9

Or

A system is described by a third-order differential equation :

$$\dddot{x} + 7\ddot{x} + 14\dot{x} + 8x = u(t) \cdot$$

Develop state-space representation where the system matrix is a diagonal one.

7. The z-transfer function of a system is given as :

$$H(z) = \frac{1}{z^2 - \frac{1}{2}z + \frac{1}{18}}.$$

Determine its delta-response.

Or

Determine the initial and final values of $y(n)$ if :

(i) $$y(z) = \frac{20z(z-0.2)(z-0.5)}{(z-1)(z^2-0.6z+0.4)}$$

(ii) $$y(z) = \frac{2z^3 - 4z^2 + 5z}{(z-1)(z^2-1.2z+0.6)}.$$