PAPER ID-312056

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

BTECH
(SEM III) THEORY EXAMINATION 2024-25
BASIC SIGNALS & SYSTEMS

TIME: 3 HRS **M.MARKS: 70**

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

SECTION A

1. Attempt *all* questions in brief. **2 x 07 = 14**

Q no.		CO	Level
a.	Define continuous time and discrete time signal with their waveform.	CO1	K2
b.	What are the major classifications of the signal?	CO1	K2
c.	What do you understand by analogous system? Explain with example	CO1	K2
d.	State Time Shifting property in relation to Fourier series.	CO2	K4
e.	Determine the Laplace transform, pole and zero locations for following time function e^{-at} u(t) for a >0; e^{-at} u(t) for a < 0;	CO3	K4
f.	The system matrix of a linear time-invariant system is $A=\begin{bmatrix}-1 & 1\\ 0 & -1\end{bmatrix}$ Determine the state transition matrix by power series method. Also, verify the result by Laplace transform method.	CO4	K3
g.	If Z[f(t)] = F(z), Determine Z[f(t+T)]	CO5	K4

SECTION B

2. Attempt any *three* of the following: **07 x 3 = 21**

Q no.		CO	Level
a.	Discuss periodic and non-periodic signals. Also show that the sinusoidal signal x(t)=sin(w_0t + θ)is periodic with period $2\pi/w_0$.	CO1	K2
b.	Differentiate between CTFT and DTFT. Also Give the Existence of DTFT	CO2	K4
c.	(i) State and prove initial value theorem for Laplace Transform. (ii) Consider the transfer function of a network given by: $F(s)=\frac{10s(s+7)}{(s+1)(s+8)(s+10)}$ Find the initial and final value of the function.	CO3	K4
d.	Obtain the solution of nonhomogeneous state equation using Laplace transformation	CO4	K3
e.	Discuss the properties of Region of Convergence (ROC) of z-transform. Also solve the following first order linear difference equation , given w(0) = -1 $w^*(t+T)+2w^*(t) = 5\ t^*$ Where function with asterisk* are defined only at t=nT for n= 0,1,2……	CO5	K4

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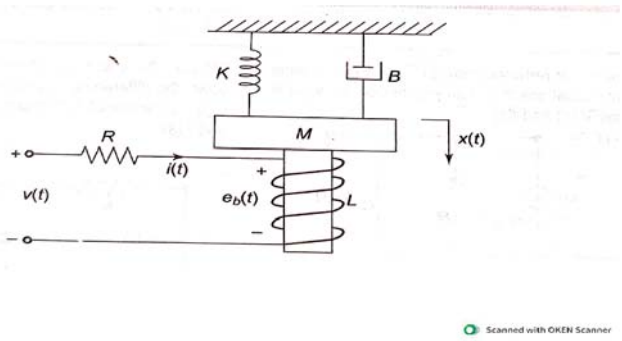
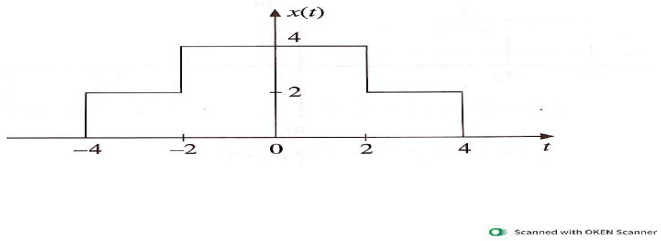
SECTION C

3. Attempt any *one* part of the following: 07 x 1 = 07

Q no.		CO	Level
a.	Explain Force Voltage and Force Current analogue in brief. For the electromechanical system shown in Fig. (a), Determine the transfer function X(s)/V(s).  Fig. (a)	CO1	K2
b.	A signal x(t) is given by $x(t)=\begin{cases} t; 0 \ll t \leq 1 \\ 1-t; 1 \ll t \leq 2 \\ 0; otherwise \end{cases}$ Sketch x(t) and $x_a(t)$ for T_0=2 and T_0 =1.	CO1	K2

4. Attempt any *one* part of the following: 07 x 1 = 07

Q no.		CO	Level
a.	Find the Fourier transform of the signal $x(t) = e^{-\lvert t \rvert}$ for -2≤t≤2 =0 otherwise	CO2	K4
b.	Determine the Fourier transform of the signal shown in Fig. (b)  Fig (b)	CO2	K4

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5. Attempt any *one* part of the following: 07 x 1 = 07

Q no.		CO	Level
a.	Given $x(t) = e^{-t}u(t)$ .Find the inverse Laplace transform of $e^{-3s}X(2s)$.	CO3	K4
b.	A system is described by the differential equation $\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = x(t)$ Determine the response of the system to an input $x(t) = e^{-2t}u(t)$ applied at t=0. The initial conditions are $y(0^-) = 2$ and $dy(0^-)/dt = -1$	CO3	K4

6. Attempt any *one* part of the following: 07 x 1 = 07

Q no.		CO	Level
a.	A state variable description of a system is given by the matrix equation $\dot{X}\begin{bmatrix}-1 & 0\\ 1 & 2\end{bmatrix}X + \begin{bmatrix}1\\ 0\end{bmatrix}r(t) \qquad y = \begin{bmatrix}1 & 1\end{bmatrix}X$ Find (a) the transfer function Y(s)/R(s) (b) the Eigen values	CO4	K3
b.	What is homogeneous and non-homogeneous state equation? Obtain the complete solution of non-homogeneous state equation.	CO4	K3

7. Attempt any *one* part of the following: 07 x 1 = 07

Q no.		CO	Level
a.	Find the inverse Z-transform of the following function: $X(z)\frac{2z^3 - 5z^2 + z + 4}{(z-1)(z-2)}$; ROC; $\lvert z\rvert < 1$	CO5	K4
b.	A linear shift invariant system is described by the difference equation $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + x(n-1)$ With y(-1)=0 and y(-2)=-1 Find natural response of the system	CO5	K4