

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S,FE) (FT) (WP/PT) Examination May 2025 (2019 Scheme)

Course Code: EET 305**Course Name: SIGNALS AND SYSTEMS**

Max. Marks: 100

Duration: 3 Hours

PART A*(Answer all questions; each question carries 3 marks)*

Marks

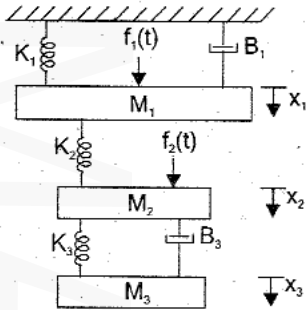
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|----|---|---|
| 1 | Find which of the following signals are causal or non-causal? | 3 |
| | i) $x_1(t) = e^{at} u(t)$ | |
| | ii) $x_2(t) = e^{-2t} u(-t)$ | |
| 2 | What are deterministic and random signals? | 3 |
| 3 | Find the Fourier Transform of $x(t) = 5 \sin^2(3t)$ | 3 |
| 4 | Explain with a neat tabular column Torque-Voltage Analogy | 3 |
| 5 | Define BIBO stability. What is the requirement of BIBO stability? | 3 |
| 6 | What do you mean by order and type of a system ? | 3 |
| 7 | State the Sampling Theorem. Also define the term Nyquist rate. | 3 |
| 8 | Write any three properties of Region of Convergence. | 3 |
| 9 | Find the Fourier transform of $x(n) = a^n u(n)$. | 3 |
| 10 | Find the frequency response of the following causal system
$y(n) = \frac{1}{2} x(n) + x(n-1) + \frac{1}{2} x(n-2)$ | 3 |

PART B*(Answer one full question from each module, each question carries 14 marks)***Module -1**

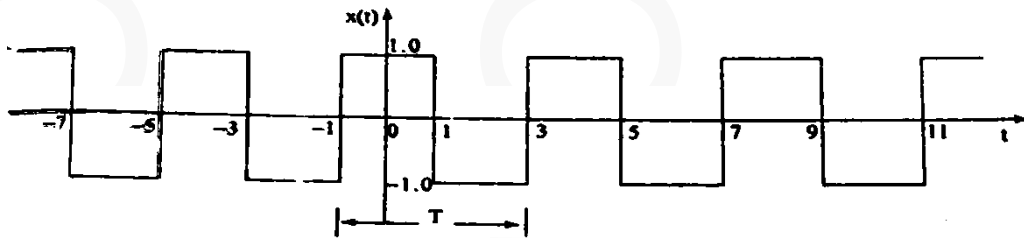
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|----|--|---|
| 11 | a) What are periodic and non-periodic signals? Check whether the following signal is periodic or not: $x(t) = \cos 60\pi t + \sin 50\pi t$ | 6 |
| | b) Find the convolution of $x_1(t)$ and $x_2(t)$ for the following signals | 8 |
| | i) $x_1(t) = t u(t)$; $x_2(t) = u(t)$ | |
| | ii) $x_1(t) = \sin t u(t)$; $x_2(t) = u(t)$ | |
| 12 | a) For a full wave rectifier, the output is modulus of the input. Check whether the system is i) Static ii) Linear iii) Time-Invariant | 9 |
| | b) Find the even and odd components of the signal $x(t) = \cos t + \sin t + \cos t \sin t$ | 5 |

Module -2

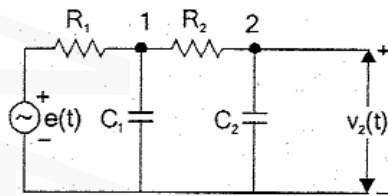
- 13 a) Write the differential equations governing the mechanical system shown in figure. 10
 Draw the Force-Voltage and Force-Current electrical analogous circuits.



- b) What are the conditions for existence of Fourier Transform? 4
 14 a) Find the trigonometric Fourier Series for the periodic signal $x(t)$ shown in Figure 9

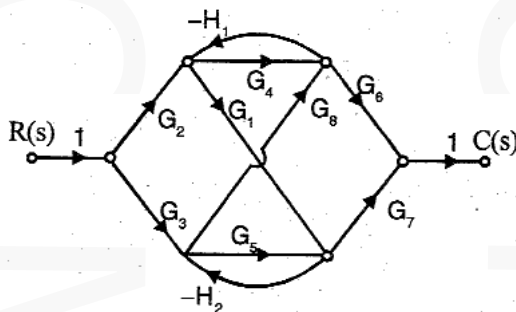


- b) Obtain the transfer function of the electrical network shown in Figure 5

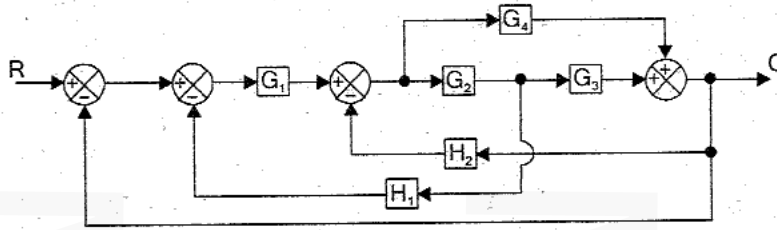


Module -3

- 15 a) Find the overall gain of the system whose signal flow graph is shown in Figure 10



- b) Derive the expression for response of a First order Closed loop system for Unit Step input. 4
 16 a) Using block diagram reduction technique find closed loop transfer function of a system whose block diagram is shown in Figure 8



- b) Check the stability of the system represented by the characteristic equation using Routh Stability criterion : $s^4+8s^3+18s^2+16s+5=0$. Comment on the location of roots of the characteristic equation 6

Module -4

- 17 a) Determine the Z-transform of $x(n) = a^n u(n) - b^n u(-n-1)$ and find ROC 8
 b) Explain the aliasing effect in sampled data systems 6
 18 a) Find the inverse Z-transform of the following: 9

i) $X(z) = \frac{(\frac{1}{4}z^{-1})}{(1-\frac{1}{2}z^{-1})(1-\frac{1}{4}z^{-1})}$, ROC: $|z| > \frac{1}{2}$

ii) $X(z) = \frac{(8z-9)}{(z^2-5z+6)}$, ROC: $|z| > 3$

- b) Derive the transfer function of Zero Order Hold. 5

Module -5

- 19 a) Find the DTFS representation for $x(n) = 5 + \sin(\frac{n\pi}{2}) + \cos(\frac{n\pi}{4})$ 7
 b) Find the step response for the following system: 7
 $y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n)$ Assume initial conditions to be zero.
 20 a) Obtain the cascade form realization of the system described by the difference equation $y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) + 3x(n-1) + 2x(n-2)$ 9
 b) State and prove the Time-Shifting Property of DTFT 5
