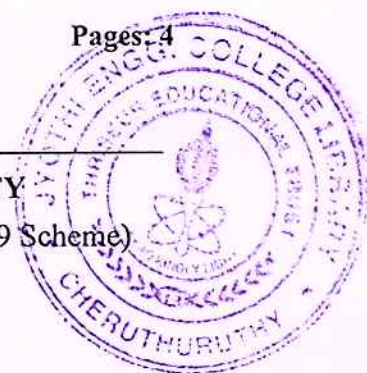


Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S,FE) (FT/WP/PT) Examinations May/June 2026 (2019 Scheme)



Course Code: EET305

Course Name: SIGNALS AND SYSTEMS

Max. Marks: 100

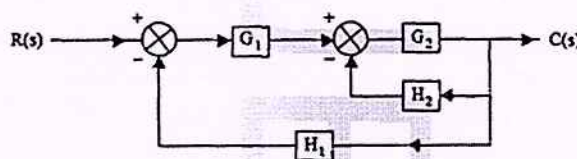
Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks)

Marks

- 1 Determine whether the signal $x(t) = \cos t$ is odd or even 3
- 2 A system is described by the input output relation $y(t) = x(2t)$. Check whether the system is static causal and time invariant 3
- 3 Explain the Dirichlet's conditions for existence of Fourier series 3
- 4 Derive the electrical analogous elements corresponding to elements of mechanical translational system with force current analogy 3
- 5 Determine the transfer function using block diagram reduction 3



- 6 Explain the concept of positive real functions 3
- 7 Explain a ZOH circuit and derive its transfer function 3
- 8 Explain Nyquist sampling Theorem 3
- 9 Check the stability of the system whose characteristic equation is given by $2z^4 + 7z^3 + 10z^2 + 4z + 1 = 0$ using Jury's stability criterion 3
- 10 Solve for the impulse response of a discrete time system having transfer function as $H(z) = \frac{z}{z-5}$ 3

PART B

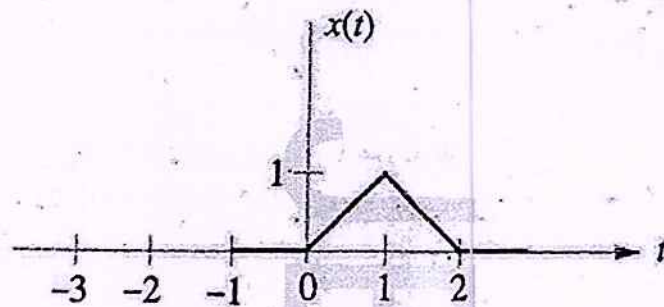
(Answer one full question from each module, each question carries 14 marks)

Module -1

- 11 a) Differentiate between energy and power signals. Determine whether the following signal $x(t) = e^{-4t}u(t)$ is an energy signal or power signal. 6

- b) For the signal $x(t)$ Find i) $x(t+1)$ ii) $x(3t-2)$ iii) $x(t/2)$ iv) $x(t+1) + x(t+3)$

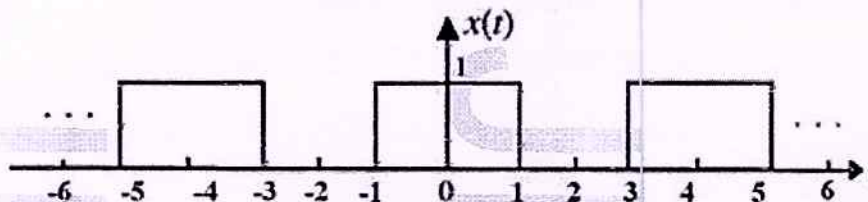
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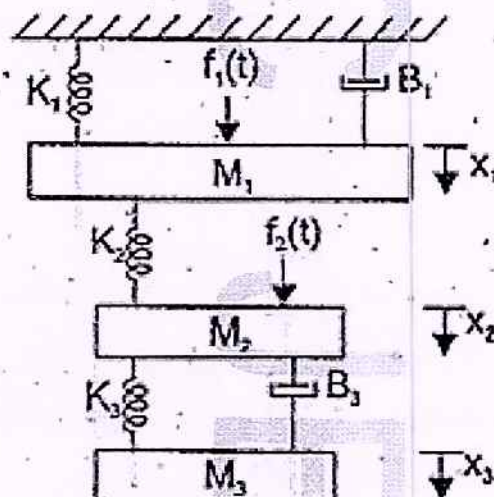
- 12 a) Find the convolution $y(t) = x_1(t) * x_2(t)$ where $x_1(t) = \sin 5t u(t)$ and $x_2(t) = u(t)$ 7
 b) Find the output of a system with impulse response $h(t) = e^{-4t} u(t)$ and the input signal $x(t) = u(t-4) - u(t-6)$ 7

Module -2

- 13 a) Find the Fourier transform of the function $x(t) = \sin \omega_0 t u(t)$ 7
 b) Find the exponential Fourier series of the periodic signal with a period of 4 7

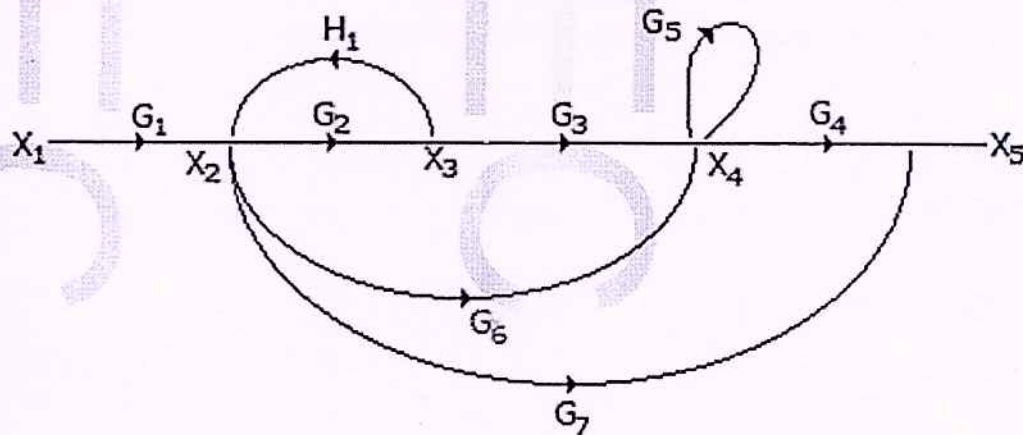


- 14 a) Write the differential equations governing the behaviour of the mechanical system shown in figure. Also obtain an analogous electrical circuit based on i) force voltage analogy ii) force current analogy 14



Module -3

- 15 a) State and explain Hurwitz criterion for analysing the stability of LTI system 5
 b) Find the range of K for a unity feedback system whose open loop transfer function is given by $G(s) = \frac{K}{s(s+7)(s+11)}$ 9
- 16 a) Determine the transfer function of the given signal flow graph using Masons gain formula 9



- b) Check the stability of the system represented by the following characteristic equation $s^4 + 8s^3 + 18s^2 + 16s + 5$ using Routh Stability criteria 5

Module -4

- 17 a) Determine the convolution sum of the two sequences $x(n) = \{1,3,4,2\}$ and $h(n) = \{1,2,2,1\}$ 6
 b) Show that the sequences $x(n) = a^n u(n)$ and $y(n) = -a^n u(-n-1)$ have same Z transform but different ROC 8
- 18 a) Determine the inverse Z transform of the following function 10

$$X(z) = \frac{z^2}{(z-1)(z-3)}$$

Find $x(n)$ for

- i) $|z| > 3$
 ii) $|z| < 1$
 iii) $1 < |z| < 3$

- b) Explain aliasing effect and how it can be avoided in sampling 4

Module -5

- 19 a) Determine the impulse response and frequency response of the system represented by $y(n) - 1.5y(n-1) + 0.5y(n-2) = x(n-1) + x(n-2)$ 14
- 20 a) Obtain the direct form I and direct form II realization of the discrete time systems with system function as 8

$$H(z) = \frac{1 - 0.5z^{-1} + z^{-2}}{1 - 1.2z^{-1} + 0.36z^{-2}}$$

- b) Check the stability of the sampled data control system represented by the characteristic equation using bilinear transformation 6

$$F(z) = z^3 - 1.2z^2 + 0.55z - 0.08 = 0$$
