CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS
II–B.TECH–I–Semester End Examinations (Regular) - January- 2022
SIGNALS AND SYSTEMS
(ECE)

[Time: 3 Hours]

[Max. Marks: 70]

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question
carries 10 marks and may have a, b, c as sub questions.

## PART-A   (20 Marks)

1. a) Find whether the following signal is periodic. If it so determine its fundamental   [2M]
period.

$x(t) = \cos t + \sin \sqrt{2} t$

b) Show that the $\cos(100\pi t)$, $\cos(500\pi t)$ signals were orthogonal over one   [2M]
fundamental period 0 to 1/50.

c) Give the list of Dirichlet's conditions for the existence of Fourier series.   [2M]

d) Evaluate the following integrals.   [2M]

(i) $\int_{-1}^{1} (3t^2 + 1)\delta(t)\,dt$ (ii) $\int_{-\infty}^{\infty} (t^2 + \cos(\pi t))\delta(t-1)\,dt$

e) Define Signal and System bandwidth.   [2M]

f) Give the Paley-Wiener criterion for physical realization of LTI systems.   [2M]

g) Find the Z-Transform $x(n) = \begin{cases} a^n & 0 \le n \le N-1, a > 0 \\ 0, & Otherwise \end{cases}$ [2M]

h) State the properties of Region of convergence with respect to z-transform.   [2M]

i) Explain aliasing effect and how it can be avoided?   [2M]

j) With the necessary equations give the relation between convolution and correlation.   [2M]

PART-B   (50 Marks)

2. Find whether the following signals are energy or power or neither.   [10M]

(i) $x(t) = e^{-at} u(t); \quad a < 0$

(ii) $x(t) = A\cos(1000\pi t)$

OR

3. Compute the mean square error in signal approximation using orthogonal functions.   [10M]
Suggest how to minimize the mean square error.

4. Obtain the trigonometric Fourier series coefficients of the following periodic signal.   [10M]

OR   [10M]
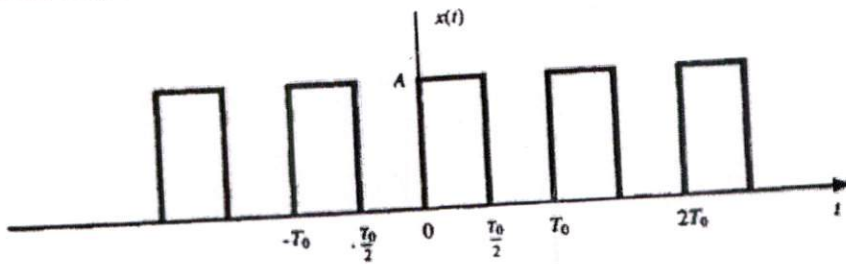
5. Evaluate the Fourier transform of the following signals.

   (i) $x(t)=\dfrac{1}{t}$ (ii) $x(t)=\pi\delta(t-t_0)+\pi\delta(t+t_0)$

6. State and prove frequency shifting and frequency convolution property of the   [10M]
   Fourier Transforms.

OR

7. What is an LTI system? Explain its properties. Derive an expression for the transfer   [10M]
   function of an LTI system. Obtain conditions for the distortion less transmission
   through a system.

8. Find the Laplace transform of the following signals and sketch its ROC.   [10M]

   (i) $x_1(t)=e^{-4t}u(t)+e^{-5t}u(t)$

   (ii) $x_2(t)=-e^{4t}u(-t)-e^{5t}u(-t)$

OR   [10M]

9. Find the inverse Z-Transform of the following.
   $X(z)=\dfrac{z}{2z^3-3z+1}$ Using partial fraction method.

[10M]

10. State and prove sampling theorem for low pass signals?

OR   10M]

11. Compute the convolution and correlation of the following two signals
    $x(t)=u(t)-u(t-3)$ $h(t)=u(t)-u(t-2)$

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