Register Number: ……..

**B.E/B.TECH DEGREE EXAMINATIONS: JUNE 2013**

Third Semester

**MAT105: TRANSFORMS IN ENGINEERING**

**(**Common to CSE & IT)

**Time: Three Hours** **Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. The value to which the Fourier series $f(x)=\begin{cases}\pi+x, -\pi\le x\le 0\\ 0, \quad 0\le x<\pi\end{cases}$ converges at x = 0 is

   a) $\pi$ b) $\pi/2$

   c) $2\pi$ d) 0

2. The value of $a_o$ in the cosine series of $f(x)=x \quad in\ (0,5)$ is

   a) 25 b) 5

   c) 25/2 d) 5/2

3. The Laplace transform of $t^2e^{-3t}$ is

   a) $\frac{2}{s^3}$ b) $\frac{2}{(s+3)^3}$

   c) $-\frac{2}{(s+3)^3}$ d) $-\frac{2}{s^3}$

4. f $\lceil 1/2=\sqrt{\pi}, \lceil n+1=n\lceil n \ \ then\ L\left(t^{1/2}\right)$ =

   a) $\frac{\sqrt{\pi}}{\sqrt{s}}$ b) $\frac{\sqrt{\pi}}{2S\sqrt{s}}$

   c) $\frac{\sqrt{\pi}}{s}$ d) $\frac{\sqrt{\pi}}{2\ s}$

5. $L^{-1}\left(\frac{1}{(s+a)^n}\right)$ =

   a) $\frac{e^{-at}t^n}{n!}$ b) $\frac{e^{-at}t^{n-1}}{(n-1)!}$

   c) $\frac{e^{-at}t^{n-1}}{n!}$ d) $\frac{e^{-at}t^n}{(n-1)!}$

6. The inverse Laplace transform of $\left[\frac{a}{s^2-a^2}\right]$ is

a) sin at
b) sin hat
c) cos at
d) cos hat

7. The Fourier transform of $f(x)=\begin{cases}1, & if\ a<x<b\\ 0, & otherwise\end{cases}$ is

a) $\frac{1}{2\pi}\left(\frac{e^{-isb}-e^{-isa}}{is}\right)$
b) $\frac{1}{\sqrt{2\pi}}\left(\frac{e^{isb}+e^{isa}}{is}\right)$
c) $\frac{1}{\sqrt{2\pi}}\left(\frac{e^{isb}-e^{isa}}{is}\right)$
d) $\frac{1}{\sqrt{2\pi}}\left(\frac{e^{-isb}+e^{isa}}{is}\right)$

8. The convolution of two functions $f(x)$ & $g(x)$ is defined as $(f*g)x=$

a) $\frac{1}{\sqrt{\pi}}\int_{-\infty}^{\infty} f(t)g(x-t)dt$
b) $\frac{1}{\sqrt{\pi}}\int_{0}^{\infty} f(t)g(x-t)dt$
c) $\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} f(t)g(x-t)dt$
d) $\frac{1}{\sqrt{2\pi}}\int_{0}^{\infty} f(t)g(x-t)dt$

9. $Z(\cos n\pi/2)=$ ---------- .

a) $\frac{z^2}{z^2-1}$
b) $\frac{z^2}{z^2+1}$
c) $\frac{z^2}{z^2+1}$
d) $\frac{z}{z^2-1}$

10. The sequence $\{f(n)\}$ is called a casual sequence if

a) $f(n)=1$ *for* $n<0$
b) $f(n)=1$ *for* $n>0$
c) $f(n)=0$ *for* $n<0$
d) $f(n)=0$ *for* $n>0$

**PART B (10 x 2 = 20 Marks)**

11. State Dirichlet's conditions for Fourier series.

12. Find the constant $a_0$ of the Fourier series for the function $f(x)=x$ *in* $0\le x\le 2\pi$.

13. Find $L[\sin at]$

14. Find the Laplace transform of $\frac{\cos t}{t}$

15. Find $L^{-1}\left[\frac{1}{s^2-1}\right]$

16. Find $L^{-1}\left[\frac{2}{s(s+2)}\right]$

17. Find the Fourier Transform of $f(x)=\begin{cases}1 & in\ |x|<a\\ 0 & in\ |x|>a\end{cases}$

18. Define Fourier cosine transform and its inverse**.**

19. Find the z-transform of (n + 1) (n + 2).

20. Find $z^{-1}\left[\frac{z}{(z-1)(z-2)}\right]$.

**PART C (5 x 14 = 70 Marks)**

21. a) (i) Obtain the Fourier series expansion of $f(x)=x+x^2 \quad in(-\pi,\pi)$. (7)

(ii) Obtain the half range cosine series of $f(x)=x$ in $(0,\pi)$ (7)

**(OR)**

b) Expand f (x) in a Fourier series upto 2nd harmonic using the following table

| $x$ | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| $f$ | 9 | 18 | 24 | 28 | 26 | 30 |

22. a) i) Find Laplace Transform of $f(t)=\begin{cases}t, 0<t<1\\ 2-t, 1<t<2\end{cases}$ , $f(t+2)=f(t)$ (10)

ii) Verify the initial and final value theorem for the function $f(t)=2e^{-3t}$ (4)

**(OR)**

b) i) Find the Laplace Transform of $te^{2t}\sin 3t$ (7)

ii) Find the Laplace Transform of $\int_0^t te^{-4t}\cos 3t\,dt$ (7)

23. a) i) Find the Inverse Laplace Transforms $\log\left(\frac{s+a}{s+b}\right)$ (7)

ii) Using Convolution Theorem find the inverse Laplace Transform of $\frac{s}{(s^2+a^2)^2}$ (7)

**(OR)**

b) i) Solve the following equations, using Laplace Transform (10)

$y''-4y'+8y=e^{2t},\ y(0)=2\ \&\ y'(0)=-2$

ii) Find Laplace transform of $t^2\cos 3t$. (4)

24. a) i) Find the Fourier transform of $f(x)=\begin{cases}1-x^2 & ,|x|\le 1\\ 0 & ,|x|>1\end{cases}$, hence evaluate (7)

$$\int_0^\infty \frac{\sin s - s\cos s}{s^2}.\cos\frac{s}{2}\,ds$$

ii) Find the F.C.T. of $e^{-ax}$ & $e^{-bx}$ and hence show that (7)

$$\int_0^\infty \frac{1}{\left(x^2+a^2\right)\left(x^2+b^2\right)}dx=\frac{\pi}{2ab(a+b)}$$ by using Parseval's identity.

**(OR)**

b) i) Find the Fourier transform of $e^{-a^2x^2}$ , $a>0$. (7)

ii) State and prove convolution theorem on Fourier transforms. (7)

25. a) i) Find the Z – Transform of $\frac{1}{n(n+1)}$. (4)

ii) By using convolution theorem find the inverse Z – Transform of $\frac{z^2}{(z-a)(z-b)}$. (10)

**(OR)**

b) i) Find inverse Z – Transform of $\frac{z^3}{(z-1)^2(z-2)}$. (4)

ii) Solve the difference equation $y_{n+2}-7y_{n+1}+12y_n=2^n$, given that $y_0=y_1=0$. (10)

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