KUMARAGURU
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B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2009)

Third Semester

MAT105: TRANSFORM METHODS IN ENGINEERING

(Common to CSE/IT)

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. If $f(x) = x^3$, $-\pi < x < \pi$, then the constant term of its Fourier series is

   a) 1 b) π

   c) 0 d) 2π

2. The root mean square value of $f(x) = x^2$ in $(0,\pi)$ is

   a) $\frac{\pi^2}{5}$ b) $\frac{\pi^2}{\sqrt{5}}$

   c) $\frac{\pi}{5}$ d) $\sqrt{\frac{\pi}{5}}$

3. The period of the function sin(3x+7) is

   a) $\frac{2\pi}{3}$ b) $\frac{3\pi}{2}$

   c) $\frac{\pi}{3}$ d) 2π

4. $L(e^{at})$ is

   a) $\frac{1}{s+a},\ s>a$ b) $\frac{1}{s-a},\ s<a$

   c) $\frac{1}{s-a},\ s>a$ d) $\frac{1}{s+a},\ s<a$

5. $L^{-1}\left[\frac{s}{s^2+4s+5}\right]$ is

a) $e^{2t}\sin t$ b) $e^{-2t}\sin t$

c) $e^{-2t}\cos t$ d) $e^{2t}\cos t$

6. The initial value of $(2t+3)^2 e^{-4t}$ is

a) 3 b) 4

c) 2 d) 9

7. Fourier Transform of $e^{\frac{-x^2}{2}}$ is

a) 1 b) 0

c) $e^{\frac{-s^2}{2}}$ d) $e^{\frac{s^2}{2}}$

8. If F(s) = F[f(x)] then $F\left[\int_a^x f(x)\,dx\right]$ is equal to

a) $\frac{F(s)}{-is}$ b) $\frac{F(s)}{s}$

c) $e^{ia}\frac{F(s)}{is}$ d) $e^{ia}\frac{F(s)}{-is}$

9. If Z[f(n)]=F(z) then Z[nf(n)]=

a) $-z\frac{d}{dz}Z[f(n)]$ b) $-\frac{d}{dz}Z[f(n)]$

c) $-\frac{1}{z}\frac{d}{dz}Z[f(n)]$ d) $z\frac{d}{dz}Z[f(n)]$

10. Z[cosat] is

a) $\frac{z(z-\cos at)}{1+z^2+2\cos at}$ b) $\frac{(z-\cos at)}{1+z^2-2\cos at}$

c) $\frac{(z-\cos at)}{1+z^2+2\cos at}$ d) $\frac{z(z-\cos at)}{1+z^2-2\cos at}$

PART B (10 x 2 = 20 Marks)

11. State Dirichlet's Condition for a given function to expand in Fourier series

12. What is meant by harmonic analysis?

13. State Final value theorem on Laplace theorem.

14. Define periodic function.

15. Find the inverse Laplace transform of $\log\left(1-\frac{a}{s}\right)$.

16. State the convolution theorem on Laplace transform.

17. If F [f(x)] =F(s) then prove that F [f(x) cosax] = $\frac{1}{2}[F(s-a)+F(s+a)]$.

18. Find Fourier Sine transform of 1/x.

19. Find Z – transform of (n).

20. Find the Z – Transform of $\cos\left(\frac{n\pi}{2}\right)$.

PART C (5 x 14 = 70 Marks)

21. a) (i) Find the Fourier series of the function $f(x)=(\pi-x)^2$ in the interval (0, 2π). (7)

(ii) Obtain the half range sine series of f(x) = $\begin{cases} x & 0<x<1 \\ 2-x & 1<x<2 \end{cases}$ (7)

(OR)

b) (i) Obtain the Fourier series to represent the function f(x) = | x| , in -π < x <π. (7)

(ii) The following table gives the variations of periodic current over a period. (7)

t sec	0	T/6	T/3	T/2	2T/3	5T/6	T
A amp.	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the first harmonic.

22. a) (i) Find the Laplace transform of the periodic function $f(t)=\begin{cases} t & 0<t<a \\ 2a-t & a<t<2a \end{cases}$ (7)

where f(t+2a) = f(t)

(ii) Find the Laplace transform of $\frac{1-\cos t}{t}$ (7)

(OR)

b) (i) Find the Laplace transform of $te^{-4t}\sin 3t$. (7)

(ii) Verify initial value theorem when f (t) = $(t+2)^2 e^{-t}$. (7)

23. a) (i) Find the inverse Laplace transform of $\frac{s^2+s-2}{s(s+3)(s-2)}$. (7)

(ii) Using Convolution theorem, find $L^{-1}\left[\frac{1}{s\left(s^2+a^2\right)}\right]$ (7)

(OR)

b) Using Laplace transform, Solve $y''(t)-4y'(t)+8y(t)=e^{2t}, \quad y(0)=2, \quad y'(0)=-2$

24. a) (i) Evaluate using transform methods $\int_0^\infty \frac{dx}{\left(a^2+x^2\right)\left(b^2+x^2\right)}$ (7)

(ii) Find the Fourier cosine transform of $e^{-a^2x^2}$. (7)

(OR)

b) Find the Fourier transform of $f(x)=\begin{cases}1-x^2 & in\ |x|\le 1\\ 0, & in|x|>1\end{cases}$. Hence prove that

$$\int_0^\infty \frac{\sin s - s\cos s}{s^3}\cos\left(\frac{s}{2}\right)ds = \frac{3\pi}{16}.$$

25. a) (i) Using convolution theorem, find inverse Z transform $\frac{z^2}{\left(z-\frac{1}{2}\right)\left(z-\frac{1}{3}\right)}$ (7)

(ii) Find the Z-transform of $(n+2)^2$. (7)

(OR)

b) Solve the difference equation f(k)+3f(k-1)-4f(k-2)=0, k ≥ 2, given f(0)=3 and f(1)=-2.

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