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# PRESIDENCY UNIVERSITY, BENGALURU
## SCHOOL OF ENGINEERING

Max Marks: 80 Max Time: 120 Minutes Weightage: 40 %

## END TERM FINAL EXAMINATION

I Semester AY 2017-18 Course: **MAT 103 ENGINEERING MATHEMATICS - III** 23 DEC 2017

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**Instructions:**

i. Write legibly.
ii. Scientific and non-programmable calculators are permitted.

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**Part A (Answer ALL the questions)**

(4Q x 5M = 20 Marks)

1. Find the inverse Z transform of $U(z)=\dfrac{2z^2+3z}{(z+2)(z-4)}$.

2. Show that the function $u(x,y)=x^2-y^2+2x$ is harmonic.

3. Using Cauchy's integral formula evaluate $\oint_C \dfrac{z^2+1}{z^2-1}\,dz$, where $C$ is the circle $|z-1|=1$.

4. Find the Laurent series expansion of $f(z)=z^{-5}\sin z$ with center $z=0$.

**Part B (Answer any THREE questions)**

(3Q x 10M = 30 Marks)

5. If $U(z)=\dfrac{2z^2+5z+14}{(z-1)^4}$, determine $u_2$ and $u_3$ by means of the initial value theorem on Z transform.

6. Show that $f(z)=\sin z$ is analytic everywhere and hence find its derivative $f'(z)$.

7. Using Cauchy's integral formula for derivatives, evaluate $\oint_C \dfrac{e^{2z}}{(z+i)^4}\,dz$, where $C$ is the circle $|z|=3$.

8. Discuss the transformation $w = z^2$.

**Part C (Answer any TWO questions)**

(2Q x 15M = 30 Marks)

9. Using Z transform solve the difference equation $u_{n+2} + 4u_{n+1} + 3u_n = 2^n$ with $u_o = 0$ and $u_1 = 1$.

10. Determine the analytic function whose real part is $e^x(x\cos y - y\sin y)$.

11. Using residue theorem evaluate $\oint_C \frac{z^2}{(z-1)^2(z+2)}\,dz$, where $C$ is the circle $|z| = \frac{5}{2}$.

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# PRESIDENCY UNIVERSITY, BENGALURU
## SCHOOL OF ENGINEERING

Max Marks: 40 | Max Time: 60 Minutes | Weightage: 20 %

## TEST 2

I Semester AY 2017-2018 Course: **MAT 103 Engineering Mathematics - III** 28 October 2017

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**Instructions:**

i. Write legibly.
ii. Scientific and non-programmable calculators are permitted.

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**Part A** (3Q x 4M = 12 Marks)

**1.** Find the Z transform of $n^2+2n+1$.

**2.** Find the Z transform of $ne^{an}$.

**3.** Find the Fourier sine transform of the function $f(x)=\begin{cases} 1 & if\ \ 0\le x<2 \\ 0 & if\ \ x\ge 2 \end{cases}$.

**Part B** (2Q x 8M = 16 Marks)

**4.** Prove that $Z[\cos n\theta]=\dfrac{z^2-z\cos\theta}{z^2-2z\cos\theta+1}$ and $Z[\sin n\theta]=\dfrac{z\sin\theta}{z^2-2z\cos\theta+1}$.

**5.** Find the Fourier cosine transform of $e^{-ax}$. Hence deduce that

$$\int_0^\infty \frac{\cos sx}{s^2+a^2}\,ds = \frac{\pi}{2a}e^{-ax}\ (a>0).$$

**Part C** (1Q x 12M = 12 Marks)

**6.** Using Laplace transform solve the differential equation $\dfrac{d^2y}{dt^2}-3\dfrac{dy}{dt}+2y=e^{3t}$ with the initial conditions $y(0)=y'(0)=0$.

OR

**7.** Find the Fourier transform of the function $f(x)=\begin{cases} 1-x^2 & if\ \ |x|\le 1 \\ 0 & if\ \ |x|>1 \end{cases}$. Hence evaluate the integral $\displaystyle\int_0^\infty \frac{\sin x - x\cos x}{x^3}\cos(x/2)\,dx$.

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# PRESIDENCY UNIVERSITY, BENGALURU
## SCHOOL OF ENGINEERING

Max Marks: 40 | Max Time: 60 Minutes | Weightage: 20 %

## TEST 1

I Semester 2017-2018 | Course: **MAT 103 Engineering Mathematics - III** | 22 September 2017

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**Instructions:**

i. Write legibly.
ii. Scientific and non-programmable calculators are permitted.

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### Part A
(3Q x 4M = 12 Marks)

**1.** Find the Laplace transform of $(t+1)^2 e^{-t}$.

**2.** Find the Laplace transform of $\sin 3t - 2t\cos 2t$.

**3.** Find the inverse Laplace transform of $\dfrac{1}{s(s^2+1)}$.

### Part B
(3Q x 6M = 18 Marks)

**4.** Find $L\left[e^{-3t}\int_0^t \frac{\sin t}{t}\,dt\right]$.

**5.** Verify the initial and final value theorems for the function $f(t) = 1 + e^{-2t}$.

**6.** Find $L^{-1}\left[\dfrac{s}{s^2+4s+5}\right]$.

### Part C
(1Q x 10M = 10 Marks)

**7.** Show that the Laplace transform of the square wave function defined by $f(t) = \begin{cases} 1 & if \;\; 0 < t < a \\ -1 & if \;\; a < t < 2a \end{cases}$

with period $2a$ is $\dfrac{1}{s}\tanh\left(\dfrac{as}{2}\right)$.

OR

**8.** Find the inverse Laplace transform of $\dfrac{1}{(s+1)(s^2+4)}$.