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B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019 Third Semester Civil Engineering MA 6351 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (Common to All Branches) (Regulations 2013) Time: Three Hours Answer ALL questions.		W. V.LOH	
Third Semester Civil Engineering MA 6351 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (Common to All Branches) (Regulations 2013) Time: Three Hours Maximum: 100 Mark Answer ALL questions. PART – A (10×2=20 Mark 1. Form the partial differential equation by eliminating the arbitrary constants a and b from $z = (x - a)^2 + (y - b)^2 + 1$. 2. Find the complete integral of $p + q = x + y$. 3. State the Dirichlet's conditions for a function $f(x)$ to be expanded as a Fourier series. 4. Expand $f(x) = 1$, in $(0, \pi)$ as a half-range sine series. 5. Write all possible solutions of one dimensional heat equation $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$. 6. Using the method of separation of variables, solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ where $u(x, 0) = 6e^{-3x}$. 7. If the Fourier transform of $f(x)$ is $\Im(f(x)) = F(s)$, then show that $\Im(f(x - a)) = e^{ias} F(s)$. 8. Find the Fourier sine transform of $1/x$. 9. Find the Z – transform of $\frac{1}{n+1}$	Question	Paper Code:	91783 28/11
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 3 (f(x-a)) = e^{1as} F(s). 8. Find the Fourier sine transform of 1/x. 9. Find the Z - transform of 1/n+1 	6. Using the method of separation $u(x, 0) = 6e^{-3x}$.	ation of variables, solve $\frac{\partial c}{\partial x}$	$\frac{1}{x} = 2\frac{\partial u}{\partial t} + u$ where
9. Find the Z – transform of $\frac{1}{n+1}$	7. If the Fourier transform of \Im (f(x - a)) = e^{ias} F(s).	$f(x)$ is $\Im(f(x)) = F(s)$, then	show that
	8. Find the Fourier sine tran	sform of 1/x.	
10. State the final value theorem of Z transforms.			
4.	10. State the final value theor	rem of Z transforms.	
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I BANTA HARA TIAN TARAH TARAH TIK TARA

PART - B

(5×16=80 Marks)

- 11. a) i) Find the general solution of $(z^2 2yz y^2)p + (xy + zx)q = xy zx$. (8)
 - ii) Find the general solution of $(D^2 + 2DD' + D'^2)$ $z = x^2 y + e^{x-y}$. (8)
 - b) i) Find the general solution of $z = px + qy + p^2 + pq + q^2$. (8)
 - ii) Find the general solution of $(D^2 3DD' + 2D'^2 + 2D 2D')$ $z = \sin(2x + y)$. (8)
- 12. a) i) Find the Fourier series expansion of the following periodic function $f(x) = \begin{cases} 2+x-2 \le x \le 0 \\ 2-x & 0 < x \le 2 \end{cases} \text{ of period } 4 \text{ Hence deduce that }$ $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8} \,. \tag{8}$
 - ii) Find the complex form of Fourier series of $f(x) = e^{ax}$ in the interval $(-\pi, \pi)$ where a is a real constant. Hence, deduce that $\sum_{n=-\infty}^{\infty} \frac{(-1)^n}{a^2 + n^2} = \frac{\pi}{a \sinh a\pi}.$ (8)
 - b) i) Find the half range cosine series of $f(x)=(\pi-x)^2,\ 0< x<\pi.$ Hence find the sum of the series $\frac{1}{1^4}+\frac{1}{2^4}+\frac{1}{3^4}+\dots$ (8)
 - ii) Determine the first two harmonics of Fourier series for the following data.

$$x: 0 = \frac{\pi}{3} = \frac{2\pi}{3} = \pi = \frac{4\pi}{3} = \frac{5\pi}{3}$$

 $f(x): 1.98 = 1.30 = 1.05 = 1.30 = -0.88 = -0.25$

- 13. a) A tightly stretched string of length 'I'with fixed end points is initially at rest in its equilibrium position. If it is set vibrating by giving each point a velocity $y_l(x, 0) = v_0 \sin\left(\frac{3\pi x}{l}\right) \cos\left(\frac{\pi x}{l}\right)$, where 0 < x < l. Find the displacement of the string at a point, at a distance x from one end at any instant 't'. (16)
 - b) A square plate is bounded by the lines x = 0, x = 20, y = 0, y = 20. Its faces are insulated. The temperature along the upper horizontal edge is given by u(x, 20) = x (20 x), 0 < x < 20, while the other three edges are kept at 0°C. Find the steady state temperature distribution u(x, y) in the plate. (16)

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- 14. a) i) Find the Fourier Transform of f(x) if $f(x) = \begin{cases} 1 |x|, |x| < 1 \\ 0, |x| > 1 \end{cases}$ and hence evaluate the integral $\int_{0}^{\infty} \left(\frac{\sin t}{t}\right)^{4} dt$. (10)
 - ii) State and prove convolution theorem for Fourier transforms. (6)

b) i) Evaluate $\int_{0}^{\infty} \frac{dx}{(x^2 + a^2)(x^2 + b^2)}$ using transforms. (6)

- ii) Find the Fourier cosine transform of $f(x)=e^{-a^2x^2}$ and hence find $F_S\Big[xe^{-a^2x^2}\Big]$. (10)
- 15. a) i) Find $Z(r^n \cos n\theta)$ and $Z^{-1} \left[(1 az^{-1})^{-2} \right]$. (8)
 - ii) Using convolution theorem, find $Z^{-1}\left[\frac{z^2}{(z-1/2)(z-1/4)}\right]$. (8)

(OR)

- b) i) Using Z-transform, solve the difference equation x(n+2) 3x(n+1) + 2x(n) = 0 given that x(0) = 0, x(1) = 1. (8)
 - ii) Using residue method, find $Z^{-1}\left[\frac{z}{z^2 2z + 2}\right]$. (8)