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Question Paper Code: 42767

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018 Third/Fifth Semester

Civil Engineering

MA 2211 - TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

(Common to All Branches) (Regulations 2008)

Time: Three Hours Maximum: 100 Marks Answer ALL questions. PART - A $(10\times2=20 \text{ Marks})$ 1. Write the Euler's formulae for a function f(x) in the interval $(0, 2\pi)$. **(2)** 2. What is the value of the Fourier series of a function f(x) at a point of discontinuity **(2)** x = a? 3. Find the Fourier Sine transform of e^{-ax} , a > 0. **(2)** 4. State the Convolution theorem on Fourier transforms. **(2)** 5. Form the PDE by eliminating the arbitrary constants a, b relation from the relation z = (x + a) (y + b). **(2) (2)** 6. Solve p + q = 1. 7. In the one-dimensional heat flow equation (unsteady state) $u_1 = \alpha^2 u_{xx}$, what does α^2 stand for ? **(2)** 8. Write the possible solutions of $y_{tt} = \alpha^2 y_{xx}$. **(2)** 9. Find the Z transform of $\frac{1}{n(n+1)}$. **(2)** 10. State the Final value theorem on Z-transforms. **(2)**



PART - B

(5×16=80 Marks)

- 11. a) i) Determine the Fourier series expansion of $f(x) = x^3$ in $-\pi < x < \pi$. (8)
 - ii) Fit up to second harmonics of the Fourier series for f(x) from the following data:

x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π	MASS- LISSAM
у	1.0	1.4	1.9	1.7	1.5	1.2	1.0	
		(OR)						

- b) i) Find the cosine series for $f(x) = x^2$ in $(0, \pi)$ and hence deduce the sum of the series $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \frac{1}{4^4} \dots \infty$. (8)
 - ii) Expand $f(x) = 2x x^2$ as a series of sines in the intervals (0, 3). (8)
- 12. a) i) Find the complex Fourier transform of $f(x) = \begin{cases} 1 x^2, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$ hence deduce

that
$$\int_{0}^{\infty} \left[\frac{x \cos x - \sin x}{x^3} \right] \cos \left(\frac{x}{2} \right) dx = -\frac{3\pi}{16}.$$
 (8)

ii) Solve the integral equation
$$\int_{0}^{\infty} f(x) \sin sx \, dx = \begin{cases} 1, & \text{for } 0 \le s < 1 \\ 2, & \text{for } 1 \le s < 2 \\ 0, & \text{for } s \ge 2 \end{cases}$$
 (8)

each terf $w_{x,y} = w_{x,y} = (OR)$ (bendance) making own that Important with a first of the

- b) i) Find the infinite Fourier transform of $e^{-a^2x^2}$, where a > 0. (8)
 - ii) Evaluate, using transforms method, $\int_{0}^{\infty} \frac{dx}{(a^2 + x^2)(b^2 + x^2)}$, where a, b > 0. (8)



- 13. a) i) Form the partial differential equations by eliminating the arbitrary function 'f' form the relation $z = f(x^2 + y^2 + z^2)$. (8)
 - ii) Solve $\frac{\partial^2 \mathbf{z}}{\partial \mathbf{x}^2} + \frac{\partial^2 \mathbf{z}}{\partial \mathbf{x} \partial \mathbf{y}} 6 \frac{\partial^2 \mathbf{z}}{\partial \mathbf{y}^2} = \cos(3\mathbf{x} + \mathbf{y})$. (8)

(OR)

- b) i) Find the complete integral of $p^2 + q^2 = x + y$. (8)
 - ii) Solve the Lagrange equation x(y-z) p + y (z-x) q = z(x-y). (8)
- 14. a) A string is stretched and fastened to two points at a distance 'l' apart. If it is set vibrating by giving each point a velocity $y_t(x, 0) = \lambda(lx x^2)$, 0 < x < l, then find the subsequent displacement y(x, t). (16)

(OR)

b) i) Two ends A and B of a rod of length l cms have temperatures at 0° C and 100° C respectively until the state conditions prevail. If the temperature at the end B is reduced suddenly to 0° C and kept so while that of A is maintained, then find the temperature distribution of the rod at any time t.

(16)

15. a) i) Evaluate (1) Z [2ⁿ cos n θ] (2) Z⁻¹ $\left[\frac{1}{z-1/2}\right]$ (4+4)

ii) Using convolution theorem, evaluate $Z^{-1}\left[\frac{z^2}{(z-1/2)(z-1/4)}\right]$. (8)

(OR)

- b) i) Using the method of partial fractions, evaluate $Z^{-1}\left[\frac{z}{z^2+7z+1}\right]$. (8)
 - ii) Using the Z-transforms technique, solve the difference equation $u_{n+2} + 6u_{n+1} + 9u_n = 2^n$, given that $u_0 = 0 = u_1$. (8)

f(x, y) = f(x, y) for a first substance in the substance of the substance f(x, y) = f(x, y) (3)

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(5) y = ²p + ²q to torquita analysis with (= ²1 t) (d)

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(4. a). A principle attended and formered to two points at a distance of aparts. If it is an interesting the giving such points a valuative y_1 (0. 0) = $\lambda(x_0 - x^2)$, 0 < x < 1 thus the value quant displacements y_1 (0. 1).

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a) Using the X-transforms technique, solve the difference equation , $u_{m+1} = 0 u_{m+1} + 0 u_m = 10$, given that $u_0 = 0 = u_1$.