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Question Paper Code : 73768

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Third/Fifth Semester

Civil Engineering

MA 2211/MA 31/MA 1201 A/CK 201/080100008/080210001/10177 MA 301 –
TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS/
MATHEMATICS – III

(Common to all branches)

(Regulations 2008/2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. If $f(x) = x^2$ in $(0, 2\pi)$ find the value of a_0 in the Fourier series expansion.
2. State Parseval's theorem on Fourier series.
3. Find the Fourier transform of $f(x) = \begin{cases} 1 & \text{for } |x| < a \\ 0 & \text{for } |x| > a \end{cases}$
4. State convolution theorem on Fourier sine transform.
5. Form the PDE by eliminating the arbitrary constants 'a' and 'b' from $z = ax^2 + by^2$.
6. Solve $\frac{\partial^2 z}{\partial x \partial y} = 0$.
7. Classify the equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + 10(x^2 + y^2 - 10) = 0$.
8. What are the three possible solutions of one-dimensional wave equation?
9. State final value theorem on Z-transform.
10. Find Z-transform of nC_2 .

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the Fourier series expansion of $f(x) = x(2\pi - x)$ in $(0, 2\pi)$. (8)

(ii) Find the Fourier series expansion of $f(x) = \begin{cases} x-1 & \text{in } -\pi < x < 0 \\ x+1 & \text{in } 0 < x < \pi \end{cases}$. (8)

Or

(b) (i) Find the half range sine series of $f(x) = \begin{cases} x & \text{in } 0 < x < 1 \\ 2-x & \text{in } 1 < x < 2 \end{cases}$. (8)

(ii) Find the Fourier series expansion upto 2nd harmonic for the following data : (8)

x : 0 $\pi/6$ $\pi/3$ $\pi/2$ $2\pi/3$ $5\pi/6$

y : 10 12 15 20 17 11

12. (a) (i) Find the Fourier transform of $f(x)$ given by $f(x) = \begin{cases} x & \text{for } |x| \leq a \\ 0 & \text{for } |x| > a \end{cases}$. (8)

(ii) Find the inverse Fourier transform of $\frac{1}{(1+s^2)^2}$. (8)

Or

(b) (i) Find $f(x)$ if $\int_0^{\infty} f(x) \cos x \, dx = \frac{\sin s}{s}$. (8)

(ii) Evaluate $\int_{-\infty}^{\infty} \frac{x^2}{(x^2+4)(x^2+9)} dx$ using Fourier sine transform. (8)

13. (a) (i) Form a PDE by eliminating arbitrary function 'f' and 'g' from $z = yf(x) + xg(y)$. (8)

(ii) Solve the equation $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$. (8)

Or

(b) (i) Solve completely the equation $p^2 + q^2 = z$. (8)

(ii) Solve $(D^2 + 2DD' + D'^2)z = x^2y + e^{x-y}$. (8)

14. (a) A string is stretched between two fixed points at a distance l cm and the points of the string are given initial velocity $v = \lambda(lx - x^2)$ for $0 < x < l$. find the displacement function $y(x, t)$. (16)

Or

- (b) A square plate has its faces and its edge $y=0$ insulated. Its edges $x=0$ and $x=10$ are kept at temperature zero and its edge $y=10$ at 100°C . Find the steady state temperature in the plate. (16)

15. (a) (i) Find Z-transform of $f(n)$ if

$$f(n) = \begin{cases} a^n & \text{for } 0 \leq n \leq N-1 \\ 0 & \text{otherwise} \end{cases} \quad (8)$$

- (ii) Using Z-transform solve $y(n+2) - 4y(n) = 2^n$ given that $y(0) = 0 = y(1)$. (8)

Or

- (b) (i) Find Z-transform of $\frac{2n+3}{(n+1)(n+2)}$. (8)

- (ii) Find Inverse Z-transform of $\frac{z^2}{(z+a)^2}$ using convolution theorem. (8)
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