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ECE

Question Paper Code : 50779

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Third Semester
Civil Engineering
MA 6351 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

(Common to Mechanical Engineering (Sandwich)/ Aeronautical Engineering/
Agriculture Engineering/ Automobile Engineering/ Biomedical Engineering/
Computer Science and Engineering/ Electrical and Electronics Engineering/
Electronics and Communication Engineering/ Electronics and Instrumentation
Engineering/ Geoinformatics Engineering/ Industrial Engineering/ Industrial
Engineering and Management/ Instrumentation and Control Engineering/
Manufacturing Engineering/ Marine Engineering/ Materials Science and
Engineering/Mechanical Engineering/Mechanical and Automation Engineering/
Mechatronics Engineering/ Medical Electronics/ Petrochemical Engineering/
Production Engineering/ Robotics and Automation Engineering/ Biotechnology,
Chemical Engineering/ Chemical and Electrochemical Engineering/
Food Technology/ Information Technology/ Petrochemical Technology/ Petroleum
Engineering/ Plastic Technology/Polymer Technology)
(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A

(10×2=20 Marks)

1. Find the partial differential equation by eliminating the arbitrary function 'f' from the relation $z = f(x^2 - y^2)$.
2. Find the complete integral of $\sqrt{p} + \sqrt{q} = 1$.
3. State Dirichlet's conditions for a given function $f(x)$ to be expanded in Fourier series.
4. Write the complex form of Fourier series for a function $f(x)$ defined in $-l < x < l$.

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5. What is the basic difference between the solutions of one dimensional wave equation and one dimensional heat equation ?
6. State any two solutions of the Laplace equation $u_{xx} + u_{yy} = 0$ involving exponential terms in x or y .
7. If $F[f(x)] = F(s)$, then find $F[f(ax)]$.
8. State the convolution theorem for Fourier transforms.
9. Find the Z-transform of the function $f(n) = 1/n$.
10. Form the difference equation by eliminating arbitrary constant 'a' from $y_n = a \cdot 2^n$.

PART - B

(5×16=80 Marks)

11. a) i) Find the singular integral of $z = px + qy + p^2 - q^2$. (8)
 ii) Find the general integral of $(x - 2z)p + (2z - y)q = y - x$. (8)
 (OR)
 b) Solve the following equations.
 i) $(D^2 + 2DD' + D'^2)z = e^{x-y} + xy$ (8)
 ii) $(D^2 - 5DD' + 6D'^2)z = y \sin x$. (8)
12. a) i) Find the Fourier series for a function $f(x) = x + x^2$ in $(-\pi, \pi)$ and hence deduce the value of $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots$ (8)
 ii) Find the Fourier series of $y = f(x)$ up to first harmonic which is defined by the following data in $(0, 2\pi)$:

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
f(x)	1	1.4	1.9	1.7	1.5	1.2	1

(8)

(OR)

- b) i) Find the half-range cosine series for $f(x) = x$ in $(0, \pi)$. Hence deduce the value

of $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$ (8)

- ii) Find the Fourier series for a function $f(x) = \begin{cases} l-x, & 0 < x \leq l \\ 0, & l < x \leq 2l \end{cases}$ in $(0, 2l)$. (8)



13. a) A tightly stretched string of length l has its end fastened at $x = 0, x = l$. At $t = 0$, the string is in the form $f(x) = kx(l - x)$ and then released. Find the displacement at any point of the string at a distance x from one end and at any time $t > 0$. (16)

(OR)

- b) A rod of length l cm has its ends A and B kept at 0°C and 100°C respectively, until steady state conditions prevail. If the temperature at B is suddenly reduced to 0°C and maintained at 0°C , find the temperature distribution $u(x, t)$ at a distance x from A at any time t . (16)

14. a) i) If $F_S(s)$ and $F_C(s)$ denote Fourier sine and cosine transform of a function $f(x)$ respectively, then show that

$$F_S\{f(x) \sin ax\} = \frac{1}{2}\{F_C(s - a) - F_C(s + a)\} \quad (4)$$

- ii) Find the Fourier transform of a function $f(x) = \begin{cases} 1 - |x| & \text{if } -1 < x < 1 \\ 0, & \text{otherwise} \end{cases}$ and hence

find the value of $\int_0^\infty \frac{\sin^4 t}{t^4} dt$ by Parseval's identity. (12)

(OR)

- b) Find the Fourier sine and cosine transforms of a function $f(x) = e^{-x}$. Using Parseval's identity, evaluate :

(1) $\int_0^\infty \frac{dx}{(x^2 + 1)^2}$ and (2) $\int_0^\infty \frac{x^2 dx}{(x^2 + 1)^2}$ (16)

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

ii) Find $Z^{-1} \left[\frac{z^2}{\left(z - \frac{1}{2}\right)\left(z - \frac{1}{4}\right)} \right]$ by using convolution theorem. (8)

(OR)

- b) i) Find the inverse Z-transform of $\frac{z^3}{(z - 1)^2(z - 2)}$ by method of partial fraction. (6)

- ii) Solve the difference equation $y(n + 2) - 7y(n + 1) + 12y(n) = 2^n$, given that $y(0) = 0$ and $y(1) = 0$, by using Z-transform. (10)