Reg. No. : | | | | | | | | | | |

Question Paper Code : P 1381

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Third Semester

(Regulation 2004)

Civil Engineering

MA 1201 — MATHEMATICS — III

(Common to all branches of B.E./B.Tech. except Biomedical Engineering)

(Common to B.E. (Part-Time) Second Semester all branches – Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. By eliminating the arbitrary constants, form the partial differential equation from the relation $z = (x^2 + a)(y^2 + b)$.

2. Find the particular integral of $(D^2 + 3DD' + 2D'^2)\, Z = x + y$.

3. State Dirichlet's conditions for a given function to be expanded as a Fourier series.

4. To which value the half range sine series corresponding to $f(x) = x^2$ expressed in the interval $(0, 5)$ converges at $x = 5$?

5. Classify the partial differential equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$.

6. What is meant by steady state condition in one dimensional heat flow?

7. Find the Fourier cosine transform of e^{-x}, $x \geq 0$.

8. State parseval's identity in Fourier transforms.

9. Find the Z-transform of 3^n.

10. Does the Z-transform of $n!$ exist? Justify your answer.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Form the partial differential equation by eliminating the arbitrary function g from the relation $g(x^2 + y^2 + z^2, xyz) = 0$. (8)

(ii) Solve : $(3z - 4y)\,p + (4x - 2z)\,q = 2y - 3x$. (8)

Or

(b) (i) Solve : $z = px + qy + \sqrt{1 + p^2 - q^2}$. (8)

(ii) Solve : $(D^3 - 7DD'^2 - 6D'^3)\,Z = e^{2x+y} + \sin(x + 2y)$. (8)

12. (a) Expand $f(x) = x - x^2$ as a Fourier series in $-1 < x < 1$ and using this series find the R.M.S. value of $f(x)$ in the interval $(-1, 1)$. (16)

Or

(b) Find the first three harmonic of Fourier series of $y = f(x)$ from the following data : (16)

x :	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
y :	298	356	373	337	254	155	80	51	60	93	147	221

13. (a) A tightly stretched string with fixed end points $x = 0$ and $x = 10$ is initially at rest in its equilibrium position. If it is set vibrating giving each point a velocity $3x(10 - x)$, find the displacement y at any time and at any distance from end $x = 0$. (16)

Or

(b) A rectangular plate with insulated surfaces is 8 cm wide and so long compared to its width that it may be considered as an infinite plate. If the temperature along short edge $y = 0$ is $u(x, 0) = 100 \sin\left(\frac{\pi x}{8}\right)$, $0 < x < 8$, while two long edges $x = 0$ and $x = 8$ as well as the other short edge are kept at 0°C. Find the steady-state temperature at any point of the plate. (16)

14. (a) Find the Fourier sine and cosine transform of x^{n-1}, $0 < n < 1$. Hence show that $\frac{1}{\sqrt{x}}$ is self reciprocal under both the transforms. (16)

Or

(b) Find the Fourier transform of $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a > 0 \end{cases}$ and deduce the value of

(i) $\int_0^\infty \frac{\sin t}{t}\, dt$ and

(ii) $\int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt$. (16)

15. (a) (i) Form the difference equation whose solution is $y_n = (A + Bn)2^n$. (8)

(ii) Evaluate the inverse Z transform of $\frac{z^2}{(z-5)(z-4)}$, using convolution theorem. (8)

Or

(b) (i) Find the value of Z transform of $\sin^2\left(\frac{n\pi}{4}\right)$. (8)

(ii) Solve the difference equation $y_{k+2} + 2y_{k+1} + y_k = k$, given $y_0 = y_1 = 0$ using Z transform. (8)