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

Question Paper Code : MA8151

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

First Semester

Civil Engineering

MA 8151 – ENGINEERING MATHEMATICS – I

(Common to All Branches/Except B.E Marine Engineering)

(Regulations 2017)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions

PART – A**(10×2=20 Marks)**

1. Evaluate $\lim\limits_{x\to 1}\dfrac{x^4-1}{x^3-1}$, if it exists.
2. Find the derivative of the function $f(x)=\sqrt[3]{1+\tan x}$.
3. Find dy/dx, when $x^2 + y^2 = xy$.
4. Are u = x + y and v = x – y functionally dependent ? Justify the claim.
5. Evaluate the integral $\int_0^3 (x-1)dx$ by interpreting in terms of areas.
6. Evaluate the improper integral $\int_0^\infty \frac{1}{x}dx$.
7. Sketch the region of integration of the integral $\int_0^1\int_0^x f(x,y)dy\,dx$ and change the order of integration.
8. Evaluate the triple integral $\int_0^1\int_0^y\int_0^{x+y} dz\,dx\,dy$.
9. Find the particular integral of $y''-6y'+9y=2e^{3x}$.
10. Solve $y'''-7y'-6y=0$.

PART – B **(5×16=80 Marks)**

11. a) i) Find the values of 'a' and 'b' such that the function

$$f(x)=\begin{cases} x+2, & x<2 \\ ax^2-bx+3, & 2\le x<3 \\ 2x-a+b, & x\ge 3 \end{cases}$$

is continuous everywhere. **(8)**

ii) Find the derivative of the function $f(x)=1/\sqrt{x}$ using the definition of derivative. State the domain of the function and the domain of its derivative. **(8)**

(OR)

b) i) Prove the statement $\lim_{x\to 1}\frac{2+4x}{3}=2$, using the ε, δ definition of a limit. **(6)**

ii) Find the maximum and a minimum values of $f(x)=\frac{x^2+x+1}{x^2-x+1}$. **(10)**

12. a) i) If $u = x^2 \tan^{-1}(y/x) - y^2 \tan^{-1}(x/y)$, then find the value of $x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}$, using Euler's theorem. **(8)**

ii) Expand $f(x, y) = e^x \sin y$ in powers of $(x+1)$ and $(y-(\pi/4))$ up to second degree terms by using Taylor's theorem. **(8)**

(OR)

b) i) If $z = f(x, y)$, where $x = e^u \cos v$ and $y = e^u \sin v$, then show that $x\frac{\partial z}{\partial v}+y\frac{\partial z}{\partial u}=e^{2u}\frac{\partial z}{\partial y}$. **(7)**

ii) Find the volume of the greatest rectangular parallelopiped that can be inscribed in the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$, using Lagrange's method. **(9)**

13. a) i) A particle moving along a straight line such that its velocity at time t is $v(t) = t^2 - t - 6$ m/sec. Find the displacement of the particle during the time period $1 \le t \le 4$, and also find the distance traveled during this time period. **(8)**

ii) Find $\int \tan^5\theta \sec^7\theta \, d\theta$. **(8)**

(OR)

b) i) Evaluate the integrals

1) $\int x^3 \cos(x^4 + 2)dx$ and

2) $\int_1^2 \frac{1}{(3-5x)^2} dx$. **(4+4)**

ii) Evaluate $\int \frac{x^2 + x + 1}{(x-1)^2(x-2)} dx$, by using partial fraction. **(8)**

14. a) i) Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2 + y^2)} dx\, dy$ by changing to polar co-ordinates and hence find the value of $\int_0^\infty e^{-x^2} dx$. **(8)**

ii) Find, by using triple integrals, the volume of the sphere $x^2 + y^2 + z^2 = a^2$. **(8)**

(OR)

b) i) Evaluate integral $\int_0^1 \int_{x^2}^{2-x} xy \, dy\, dx$ by changing the order of integration. **(8)**

ii) Find the volume of the tetrahedron bounded by the co-ordinate planes and the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$. **(8)**

15. a) i) Solve the simultaneous equations $\frac{dx}{dt} - y = t, \frac{dy}{dt} + x = t^2$. **(8)**

ii) Solve $(D^2 + 1)y = \sin x + \cos x$ by the method of undetermined coefficients. **(8)**

(OR)

b) i) Solve $y'' + \frac{1}{x} y' = 12 \frac{\log x}{x^2}$. **(6)**

ii) Solve $(D^2 + a^2)y = \tan(ax)$ by the method of variation of parameters. **(10)**