Reg. No. :

Question Paper Code : 90330

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

First Semester

Civil Engineering

MA 8151 – ENGINEERING MATHEMATICS – I

(Common to all Branches (Except Marine Engineering))

(Regulations 2017)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. Given that $\lim_{x\to2} f(x) = 4$ and $\lim_{x\to2} g(x) = -2$. Find the limit that exists for $\lim_{x\to2}\left[\frac{3f(x)}{g(x)}\right]$.

2. If $f(x) = xe^x$ then find the expression for $f''(x)$.

3. Verify the Euler's theorem for the function $u = x^2 + y^2 + 2xy$.

4. If $x = r\cos\theta$ and $y = r\sin\theta$, then find $\frac{\partial(x, y)}{\partial(r, \theta)}$.

5. Find the derivative of $G(x) = \int_x^1 \cos\sqrt{t}\, dt$.

6. Determine whether the given integral $\int_0^\infty e^x\, dx$ is convergent or divergent.

7. Evaluate $\int_1^2\int_0^{x^2}(x)\, dy\, dx$.

8. Express the region $x \geq 0, y \geq 0, z \geq 0, x^2 + y^2 + z^2 \leq 1$ by triple integration.

9. Solve $(D^4 - 2D^2 + 1)y = 0$.

10. Convert $xy'' + y' = 0$ into a linear differential equation with constant coefficients.

PART – B (5×16=80 Marks)

11. a) i) If $f(x) = \dfrac{1-x}{2+x}$ then, find the equation for $f'(x)$ using the concept of derivatives. (8)

ii) Find the derivative of $f(x) = \tan h^{-1}\left[\tan\dfrac{x}{2}\right]$. (8)

(OR)

b) For the function $f(x) = 2x^3 + 3x^2 - 36x$. (16)

i) Find the intervals on which it is increasing and decreasing.

ii) Find the local maximum and minimum values of f.

iii) Find the intervals of concavity and the inflection points.

12. a) i) For the given function $z = \tan^{-1}\left(\dfrac{x}{y}\right) - (xy)$, verify whether the statement $\dfrac{\partial^2 z}{\partial x\,\partial y} = \dfrac{\partial^2 z}{\partial y\,\partial x}$, is correct or not. (8)

ii) A thin closed rectangular box is to have one edge equal to twice the other and constant volume 72 m^3. Find the least surface area of the box. (8)

(OR)

b) i) Obtain the Taylor's series expansion of $e^x \sin y$ in terms of powers of x and y upto third degree terms. (8)

ii) Find the maximum or minimum values of the function $f(x, y) = x^2 + y^2 + 6x + 12$. (8)

13. a) i) Evaluate $\int e^x \sin x\,dx$ by using integration by parts. (8)

ii) Evaluate $\int_0^{\pi} \sin^2 x \cos^4 x\,dx$. (8)

(OR)

b) i) Evaluate $\int_0^3 (x^3 - 6x)dx$ by using Riemann sum with n sub intervals. (8)

ii) Evaluate $\int \sqrt{a^2 - x^2}\,dx$ by using substitution rule. (8)

14\. a) i) Evaluate $\iint (xy)\, dx\, dy$ over the positive quadrant of the circle $x^2 + y^2 = a^2$. **(8)**

ii) Change the order of integration for the given integral $\int_0^a \int_{\frac{x}{a}}^{\sqrt{\frac{x}{a}}} (x^2 + y^2)\, dy\, dx$ and evaluate it. **(8)**

(OR)

b) i) Find the area bounded by $y^2 = 4x$ and $x^2 = 4y$ by using double integrals. **(8)**

ii) Evaluate $\int_0^{2a} \int_0^{x} \int_y^{x} (x\, y\, z)\, dz\, dy\, dx$. **(8)**

15\. a) i) Solve the simultaneous differential equation $Dx + y = \sin 2t$ and $-x + Dy = \cos 2t$. **(8)**

ii) Solve $(x+2)^2 \frac{d^2y}{dx^2} - (x+2)\frac{dy}{dx} + y = 3x + 4$. **(8)**

(OR)

b) i) Solve $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$ by using the method of variation of parameters. **(8)**

ii) Solve $(D^2 + 3D + 2)y = 4e^{2x} + x$ by using the method of undetermined coefficients. **(8)**