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

estion Paper Code : 80206

. DEGREE EXAMINATIONS, APRIL/MAY 2019.

First Semester

Civil Engineering

MA 8151 — ENGINEERING MATHEMATICS – I

(Common to All Branches (Except Marine Engineering))

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Check whether $\lim_{x \to -3} \frac{3x+9}{|x+3|}$ exist.

2. Find the critical points of $y = 5x^3 - 6x$.

3. Find $\frac{du}{dt}$ in terms of t, if $u = x^3 + y^3$ where $x = at^2$, $y = 2at$.

4. If $x = u^2 - v^2$, $y = 2uv$ find the Jacobian of x, y with respect to u and v.

5. Evaluate $\int_0^{\frac{\pi}{2}} \frac{dx}{1+\tan x}$.

6. Evaluate $\int_3^{\infty} \frac{dx}{(x-2)^{\frac{3}{2}}}$ and determine whether it is convergent or divergent.

7. Evaluate $\int_1^a \int_2^b \frac{dx\,dy}{xy}$.

8. Find the limits of integration $\iint_R f(x, y)\,dxdy$ where R is the triangle bounded by $x = 0$, $y = 0$, $x + y = 2$.

9. Find the particular integral of $(D-a)^2 y = e^{ax}\sin x$.

10. Solve the equation $x^2y'' - xy' + y = 0$.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Find $\frac{dy}{dx}$ if $y = x^2 e^{2x}(x^2+1)^4$. (8)

(ii) For what value of the constant b, is the function f continuous on $(-\infty, \infty)$ if $f(x) = \begin{cases} bx^2+2x & \text{if } x<2 \\ x^3-bx & \text{if } x \geq 2. \end{cases}$ (8)

Or

(b) If $f(x) = 2x^3 + 3x^2 - 36x$, find the intervals on which it is increasing or decreasing, the local maximum and local minimum values of $f(x)$. (16)

12. (a) (i) If $u = f(2x-3y, 3y-4z, 4z-2x)$, then find $\frac{1}{2}\frac{\partial u}{\partial x} + \frac{1}{3}\frac{\partial u}{\partial y} + \frac{1}{4}\frac{\partial u}{\partial z}$. (8)

(ii) Find the shortest and the longest distances from the point $(1, 2, -1)$ to the sphere $x^2+y^2+z^2 = 24$. (8)

Or

(b) (i) Expand $x^2y^2 + 2x^2y + 3xy^2$ in powers of $(x+2)$ and $(y-1)$ using Taylor's series upto third degree terms. (8)

(ii) Examine $f(x, y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$ for extreme values. (8)

13. (a) (i) Evaluate $\int_0^\infty e^{-ax}\sin bx\,dx\ (a>0)$ using integration by parts. (8)

(ii) Evaluate $\int_0^{\frac{\pi}{2}} \frac{\sin x\cos x}{\cos^2 x + 3\cos x + 2}dx$. (8)

Or

(b) (i) Evaluate $\int \frac{2x+5}{\sqrt{x^2-2x+10}}dx$. (8)

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

14. (a) (i) Change the order of integration in $\int_0^\infty\int_x^\infty \frac{e^{-y}}{y}dy\,dx$ and then evaluate it. (8)

(ii) Evaluate, by changing to polar coordinates $\int_0^a\int_y^a \frac{x^2\,dx\,dy}{\sqrt{x^2+y^2}}$. (8)

Or

(b) (i) Evaluate $\iint xy\,dx\,dy$ over the region in the positive quadrant bounded by $\frac{x}{a}+\frac{y}{b}=1$. (8)

(ii) Find the value of $\iiint xyz\,dz\,dy\,dx$ through the positive spherical octant for which $x^2+y^2+z^2 \leq a^2$. (8)

15. (a) (i) Solve by the method of variation of parameters : $\frac{d^2y}{dx^2} + a^2y = \tan ax$. (8)

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

Or

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

(ii) Solve : $\frac{dx}{dt} + \frac{dy}{dt} + 3x = \sin t$, $\frac{dx}{dt} + y - x = \cos t$. (8)

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