

G H RAISONI COLLEGE OF ENGINEERING AND MANAGEMENT, PUNE
(An Autonomous Institute Affiliated to SPPU)
Department of First Year B.Tech /Term-II (AY 2023-24)
CAE-1 Question Bank
Integral Calculus and Differential Equations (23UBSL1201)
Branch: Common to All

Q.NO.	QUESTIONS	CO	BL
1	Trace the curve a. $y^2(2a - x) = x^3$ b. $x^2y^2 = a^2(y^2 - x^2)$	CO1	L3
2	Evaluate a) $\int_0^{\infty} \sqrt[4]{x} e^{-\sqrt{x}} dx$ b) $\int_0^{\infty} x^7 e^{-2x^2} dx$ c) $\int_0^{\infty} \frac{x^a}{a^x} dx$ ($a > 0$) d) $\int_0^1 (x \log x)^4 dx$	CO1	L3
3	Prove that $\int_0^1 x^3 (1 - \sqrt{x})^5 dx = \frac{1}{5148}$	CO1	L3
4	Show that $\int_0^{\pi/2} \sqrt{\tan \theta} d\theta \cdot \int_0^{\pi/2} \sqrt{\cot \theta} d\theta = \frac{\pi^2}{2}$	CO1	L3
5	Prove that $\int_0^{\infty} \frac{dx}{1+x^4} = \frac{\pi}{2\sqrt{2}}$	CO1	L3
6	Prove that $\int_0^2 x(8-x^3)^{\frac{1}{3}} dx = \frac{16\pi}{9\sqrt{3}}$	CO1	L3
7	Evaluate $\int_2^5 (x-2)^3 (5-x)^2 dx$	CO1	L3
8	Evaluate $\int_0^{\infty} \frac{x^8(1-x^6)}{(1+x)^{24}} dx$	CO1	L3
9	Prove that $\int_0^1 \frac{x^a - 1}{\log x} dx = \log(a+1)$, $a \geq 0$	CO1	L4
10	Find $\frac{dI(a)}{da}$ if $I(a) = \int_{\pi/6a}^{\pi/2a} \frac{\sin ax}{x} dx$	CO1	L3
11	Verify DUIS Rule – 2 for $I(a) = \int_a^{a^2} \log(ax) dx$	CO1	L2
12	Evaluate $\int_0^1 \int_0^x (x^2 + 3y) dy dx$	CO1	L3

13	Show that $\int_0^1 \int_{-\sqrt{y}}^{-y^2} xy \, dx \, dy = \frac{-1}{12}$	CO1	L3
14	Evaluate $\iint x^2 y^2 \, dx \, dy$ over the positive quadrant of the circle $x^2 + y^2 = 1$	CO1	L3
15	Show that $\int_0^1 \int_0^1 \frac{dx \, dy}{\sqrt{(1-x^2)(1-y^2)}} = \frac{\pi^2}{4}$	CO1	L3
16	Evaluate $\int_0^1 \int_0^1 \frac{dx \, dy}{\sqrt{(1-x^2)(1-y^2)}}$	CO1	L3
17	Evaluate $\iint \frac{1}{(x^4+y^2)} \, dx \, dy$ over region $y \geq x^2, x \geq 1$.	CO1	L3
18	Evaluate $\iint y \, dx \, dy$, over the area bounded by $y = x^2$ and $y = x$.	CO1	L3
19	Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \frac{dx \, dy}{(1+e^y)\sqrt{1-x^2-y^2}}$ by changing the order of integration	CO1	L3
20	Evaluate $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} \, dx \, dy$ by changing the order of integration	CO1	L3

Blooms Taxonomy level: 1- Remembering, 2- Understanding, 3 -Applying, 4 - Analyzing,
5 -Evaluating, 6 - Creating

G H RAISONI COLLEGE OF ENGINEERING AND MANAGEMENT, PUNE
(An Autonomous Institute Affiliated to SPPU)
Department of First Year B. Tech /Term-II (AY 2023-24)
CAE-2 Question Bank
Integral Calculus and Differential Equations (23UBSL1203)
Branch: Common to All

Q. NO.	QUESTIONS	CO	BL
1	Evaluate $\int_C \vec{F} \cdot d\vec{r}$ for $\vec{F} = 3x^2\mathbf{i} + (2xz - y)\mathbf{j} + z\mathbf{k}$ along the following paths a. the straight line joining the points (0,0,0) and (2,1,3). b. Along the curve $x = 2t^2, y = t, z = 4t^2 - t$ from $t = 0$ to $t = 1$. c. Along the curve defined by $x^2 = 4y, 3x^3 = 8z$ from $x = 0$ to $x = 2$	CO2	L3
2	Evaluate $\int_C \vec{F} \cdot d\vec{r}$ for $\vec{F} = (2x + 3)\mathbf{i} + xy\mathbf{j} + (yz - x)\mathbf{j}$ along the following paths: a. the straight lines from (0,0,0) to (0,0,1) then from (0,1,1) to (2,1,1). b. The straight line joining (0, 0, 0) and (3, 1, 1).	CO2	L3
3	Find the work done in moving a particle once round the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1, z = 0$ under the field of force given by $\vec{F} = (2x - y + z)\mathbf{i} + (x + y - z^2)\mathbf{j} + (3z - 2y + 4z)\mathbf{k}$.	CO2	L3
4	Find the work done by the force $(x^2 - yz)\mathbf{i} + (y^2 - xz)\mathbf{j} + (z^2 - xy)\mathbf{k}$ in taking particle from (1, 1, 1) to (2, 2, 0).	CO2	L3
5	Verify Greens theorem for $\vec{F} = x\mathbf{i} + y^2\mathbf{j}$ over the first quadrant of the circle $x^2 + y^2 = a^2$	CO2	L3
6	Evaluate $\oint_C [\cos y\mathbf{i} + x(1 - \sin y)\mathbf{j}] \cdot d\vec{r}$ for the closed curve which is given by $x^2 + y^2 = 1, z = 0$.	CO2	L3
7	Verify Greens theorem for $\vec{F} = x^2\mathbf{i} + xy\mathbf{j}$ over the region R bounded by $y = x^2$ and the line $y = x$.	CO2	L4
8	Evaluate $\oint_C (\sin y - y^3)dx + (xy^2 + x \cos y)dy$ by using Green's theorem , Where C is the circle $x^2 + y^2 = a^2$	CO2	L3
9	Verify Stokes theorem for $\vec{F} = xy^2\mathbf{i} + y\mathbf{j} + xz^2\mathbf{k}$ for the surface of rectangular lamina bounded by $x = 0, y = 0, x = 1, y = 2, z = 0$.	CO2	L4
10	Verify Stokes theorem for $\vec{F} = (2x - y)\mathbf{i} - yz^2\mathbf{j} - zy^2\mathbf{k}$ and S is the surface of Hemisphere $x^2 + y^2 + z^2 = 1$ above XOY plane.	CO2	L4

11	Evaluate $\iint_S (\nabla \times \vec{F}) \cdot \hat{n} \, ds$ for $\vec{F} = (x^2 + y - 4)\mathbf{i} + 3xy\mathbf{j} + (2xz + z^2)\mathbf{k}$ over the surface S of Hemisphere $x^2 + y^2 + z^2 = 16$ above XOY plane.	C02	L3
12	Solve : a. $(1 + y^2) + (x - e^{-\tan^{-1}y}) \frac{dy}{dx} = 0$ b. $x^2(x^2 - 1) \frac{dy}{dx} + x(x^2 + 1)y = x^2 - 1$	C03	L3
13	Solve $(1 + x^2) \frac{dy}{dx} + xy = 1$	C03	L3
14	Solve $xy - \frac{dy}{dx} = y^3 e^{-x^2}$	C03	L3
15	Solve $\sin y \frac{dy}{dx} = \cos x (2 \cos y - \sin^2 x)$	C03	L3
16	Solve $\frac{dy}{dx} - \frac{\tan y}{1+x} = (1+x)e^x \sec y$	C03	L3
17	Solve $\cos y - x \sin y \frac{dy}{dx} = \sec^2 x$	C03	L3
18	Solve $(x + y - 2)dx + (x - y + 4)dy = 0$	C03	L3
19	Solve $\left(\frac{y^2}{(y-x)^2} - \frac{1}{x}\right) dx + \left(\frac{1}{y} - \frac{x^2}{(x-y)^2}\right) dy = 0$	C03	L3
20	Solve $\frac{dy}{dx} = \frac{\tan y - 2xy - y}{x^2 - x \tan^2 y + \sec^2 y}$	C03	L3

G H RAISONI COLLEGE OF ENGINEERING AND MANAGEMENT, PUNE
(An Autonomous Institute Affiliated to SPPU)
Department of First Year B. Tech /Term-II (AY 2023-24)
CAE-3 Question Bank
Integral Calculus and Differential Equations (23UBSL1203)
Branch: Common to All

Q.NO.	QUESTIONS	CO	BL
1	Solve $(x^2 + 1) \frac{dy}{dx} + 4xy = \frac{1}{(x^2 + 1)^2}$	C03	L4
2	Solve $(1 + x^2) \frac{dy}{dx} + xy = 1$	C03	L3
3	Solve: $\frac{dy}{dx} - \frac{\tan y}{1+x} = (1+x)e^x \sec y$	C03	L3
4	Solve $\frac{dy}{dx} = \frac{\tan y - 2xy - y}{x^2 - x \tan^2 y + \sec^2 y}$	C03	L3
5	Solve $\left(\frac{y^2}{(y-x)^2} - \frac{1}{x} \right) dx + \left(\frac{1}{y} - \frac{x^2}{(x-y)^2} \right) dy = 0$	C03	L3
6	Solve $\frac{d^2y}{dx^2} + 3 \frac{dy}{dx} + 2y = e^{e^x}$	C04	L3
7	Solve $\frac{d^3y}{dx^3} + 4 \frac{dy}{dx} = \sin 2x$	C04	L3
8	Solve $(D - 1)^3 y = e^x + 2^x - \frac{3}{2}$	C04	L3
9	Solve $\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 3y = e^{-3x}$	C04	L3
10	Solve $\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 3y = e^{-3x}$	C04	L3
11	Solve $\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 3y = e^{-3x}$	C04	L3
12	Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + 4y = \cos(\log x) + \sin(\log x)$	C04	L3
13	Solve $x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = 10 \left(x + \frac{1}{x} \right)$	C04	L3
14	Solve $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 5y = x^2$	C04	L3
15	Solve $(2x + 1)^2 \frac{d^2y}{dx^2} - 2(2x + 1) \frac{dy}{dx} - 12y = 6x$	C04	L3
16	Solve $(1 + x)^2 \frac{d^2y}{dx^2} + (1 + x) \frac{dy}{dx} + y = 2 \sin[\log(1 + x)]$	C04	L3

17	Solve $(3x + 2)^2 \frac{d^2y}{dx^2} + 3(3x + 2) \frac{dy}{dx} - 36y = 3x^2 + 4x + 1$	CO4	L3
18	Solve by method of variation of Parameters the differential equation $(D^2 + 4)y = \sec 2x$	CO4	L3
19	Solve by method of variation of Parameters the differential equation $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$	CO4	L3
20	Solve by method of variation of Parameters the differential equation $(D^2 - 6D + 9)y = \frac{e^{3x}}{x^2}$	CO4	L3

Blooms Taxonomy level: 1- Remembering, 2- Understanding, 3 -Applying, 4 - Analyzing,
5 -Evaluating, 6 - Creating