ST.ANNE'S

COLLEGE OF ENGINEERING AND TECHNOLOGY

(An ISO 9001:2015 Certified Institution)
Anguchettypalayam, Panruti – 607106.

QUESTION BANK (R-2017)

MA8151
ENGINEERING MATHEMATICS-I

ST.ANNE'S

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(An ISO 9001:2015 Certified Institution)

Anguchettypalayam, Panruti – 607106.

QUESTION BANK

PERIOD: AUG - DEC 2019 **BATCH**: 2018 – 2022

BRANCH: COMMON **YEAR/SEM:** I/01

SUB CODE/NAME: MA8151 ENGINEERING MATHEMATICS – I

UNIT I – DIFFERENTIAL CALCULUS

PART – A

1. Find the domain and range **f(x) =3x-2.**
2. Sketch the graph of the absolute value function **f(x)=**$|x|$
3. Prove that $\lim_{x\to 0}|x| = 0$.
4. If $\mathbf{x^2 + y^2 = 25}$, then find $\frac{dy}{dx}$.
5. Find the derivative $\mathbf{y = (x^3-1)^{100}}$ **.**
6. Find the domain and range $\boldsymbol{y = x^2}$**.**
7. Sketch the graph of function $|\boldsymbol{x}| = \begin{cases} \boldsymbol{x}, & \boldsymbol{if\, x} > 0 \\ -\boldsymbol{x}, & \boldsymbol{if\, x} < 0 \end{cases}$.
8. Find the $\lim_{x\to 3^+}\left(\frac{2x}{x-3}\right)$.
9. Prove that $\lim_{x\to 0}\left(\frac{|x|}{x}\right)$.
10. Define derivative of a function $f(x)$.
11. Evaluate $\lim_{x\to 1}\left(\frac{x^4-1}{x^3-1}\right)$, if it exists.
12. Find the derivative of the function $\boldsymbol{f(x) = \sqrt[3]{1+tanx}}$.
13. Sketch the graph of the function $\begin{cases} 1+x, x<-1 \\ x^2, -1\le x\le 1 \\ 2-x, x\ge 1 \end{cases}$ and use it to determine the value of "a" for which $\lim_{x\to a} f(x)$ exists? **(Jan-18)**
14. Does the curve $y = x^4 - 2x^2 + 2$ have any horizontal tangents? If so where? **(Jan-18)**
15. State Rolle's Theorem and verify the Rolle's theorem for $f(x) = x^3 + 5x^2 - 6x$ on the interval (0, 1).
16. State Mean value theorem
17. Find the critical numbers for $f'(x) = \frac{x^2(x-1)}{x+2}, x \ne -2$
18. Define concavity and point of inflection.
19. Define maxima and minima of one variable and write the conditions.
20. Find the tangent line and normal line to the given curve $\boldsymbol{y = 2xe^x}$ at (0, 0).

21. Find the domain of $f(x) = \sqrt{3-x} - \sqrt{2+x}$ **(Nov 2018)**

22. Evaluate $\lim_{t\to 1}\frac{t^4-1}{t^3-1}$ **(Nov 2018)**

23. check whether $\lim_{t\to 1}\frac{3x+9}{|x+3|}$ exist. **(APR 19)**

24. Find the critical points of $y = 5x^3 - 6x$ **(APR 19)**

PART – B

Limits

1. Find the value of $\lim_{x\to 0}\frac{\sin x}{x}$.

2. Find the domain of the functions a) $y = x^2$, b) $f(x) = \sqrt{x-2}$, c) $g(x) = \frac{1}{x^2-x}$

3. Find $\lim_{x\to 0}\left(\frac{1}{x^2}\right)$.

4. Evaluate $\lim_{x\to\frac{\pi}{2}}\frac{1+\cos 2x}{(\pi-2x)^2}$.

5. Find the limit of the function $\lim_{x\to 0}\frac{e^{5x}-1}{x}$, given numbers $x = \pm 0.5$, ± 0.1 , ± 0.01 , ± 0.001 , ± 0.001 (correct 6 decimal places) **(Nov 2018)**

Continuity

1. Show that the function **f(x) = 1-** $\sqrt{1-x^2}$ is continuous on the interval [-1, 1] .

2. Find an equation of the tangent line to the parabola **y = x^2** at the point (1,1) .

3. Find an equation of the tangent line to the hyperbola $y = \frac{3}{x}$ at the point (3,1) .

4. If $(x) = \sqrt{x}$, find the equation for $f'(x)$.

5. Determine whether $f'(0)$ exist or not for the given function

$$f(x) = \begin{cases} x\sin\left(\frac{1}{x}\right) & , x \neq 0 \\ 0 & , x = 0 \end{cases}$$

6. Where is the function $f(x) = |x|$ is differentiable?

7. Find $\lim_{t\to 0}\frac{\sqrt{t^2+9}-3}{t^2}$.

8. Find the value of $\lim_{x\to 1}\left(\frac{x-1}{x^2-1}\right)$

9. For what value of the constant "c" is the function "f" continuous on $(-\infty,\infty)$,

$$f(x)=\begin{cases} cx^2+2x, x<2 \\ x^3-cx, x\geq 2 \end{cases}$$

10. For what value of the constant "b" is the function "f" continuous on $(-\infty,\infty)$,

if $\boldsymbol{f(x)=\begin{cases} bx^2-2x & if \ \ x<2 \\ x^3-bx & if \ \ x\geq 2 \end{cases}}$ **(Apr 19)**

Differentiability

1. If the function **f(x)** is differentiable at a, then f(x) is continuous at a .
2. Find an equation of the tangent line to the hyperbola $\boldsymbol{y=\frac{3}{x}}$ at the point (3,1).
3. Find an equation of the tangent line to the parabola **y = x² -8x+9** at the point (3,-6) .
4. Where is the function $\boldsymbol{f(x)=|x|}$ is differentiable?
5. Show that $\lim_{x\to 0} x^2\sin\frac{1}{x}$ =0.
6. Show that the sum of x and x intercepts of any tangent line to the curve $\boldsymbol{\sqrt{x}}$ +$\boldsymbol{\sqrt{y}}$= $\boldsymbol{\sqrt{c}}$ is equal to c.
7. Verify that the function **f(x) = 5-12x+3x²** satisfies the Rolle's theorem on the interval **[1,3]**.
8. Find the local maximum and local minimum values of the function **g(x)=x+2sinx.**
9. Find the absolute maximum and minimum values of the function

   $\boldsymbol{f(x)=x^3-3x^2+1,\quad \frac{-1}{2}\leq x\leq 4.}$
10. Find the local maximum and local minimum values of the function

    $\boldsymbol{f(x)=2x^3+3x^2-36x.}$
11. Find the values of a and b such that the function $\boldsymbol{f(x)=\begin{cases} x+2, & x<2 \\ ax^2-bx+3, & 2\leq x<3 \\ 2x-a+b, & x\geq 3 \end{cases}}$

    is continuous everywhere.
12. Find the derivative of the function $\boldsymbol{f(x)=\frac{1}{\sqrt{x}}}$ using the definition of derivative. 0
13. Find the values of a and b such that the function $\boldsymbol{f(x)=\begin{cases} \frac{x^3-8}{x-2}, & x<2 \\ ax^2-bx+3, & 2\leq x<3 \\ 2x-a+b, & x\geq 3 \end{cases}}$ **(Nov 2018)**
14. find the derivative of $\boldsymbol{f(x)=cos^{-1}\left[\frac{b+a\ cosx}{a+b\ cosx}\right]}$ **(Nov 2018)**
15. find $\boldsymbol{y'}$ for $\boldsymbol{cos(xy)=1+sin\,y}$ **(Nov 2018)**
16. Find $\frac{dy}{dx}$ if $\boldsymbol{y=x^2e^{2x}(x^2+1)^4}$ **(Apr 19)**

Maxima and minima

1. Find the maximum and minimum values of $\boldsymbol{f(x)=\frac{x^2+x+1}{x^2-x+1}}$.
2. Find the local maximum and minimum values of $f(x)=\sqrt{x}-\sqrt[4]{x}$ using both the first and second derivative tests. **(Jan-18)**

3. Find y'' if $x^4 + y^4 = 6$. **(Jan-18)**

4. Find the tangent line to the equation $x^3 + y^3 = 6xy$ at the point (3, 3) and at what point the tangent line horizontal in the first quadrant. **(Jan-18)**

5. For the function $\boldsymbol{f(x) = 2 + 2x^2 - x^4}$ find the intervals of increase or decrease , local maximum and minimum values, concavity and inflection points (**Nov 2018)**

6. For the function $\boldsymbol{f(x) = 2x^3 + 3x^2 - 36x}$ find the intervals of increase or decrease, local maximum and minimum values. **(Apr 19)**

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PERIOD: AUG - DEC 2019 **BATCH**: 2019 – 2023

BRANCH: COMMON **YEAR/SEM:** I/01

SUB CODE/NAME: MA8151 ENGINEERING MATHEMATICS – I

UNIT II – FUNCTIONS OF SEVERAL VARIABLE

PART – A

1. If $u = \frac{y}{z} + \frac{z}{x} + \frac{x}{y}$ then find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = ?$
2. If $x^y + y^x = 1$, then find $\frac{dy}{dx} = ?$
3. If $u = x^2 + y^2$ and $x = at^2, y = 2at$, find $\frac{du}{dt}$.
4. If $x = r\cos\theta, y = r\sin\theta$, then find $\frac{\partial(x,y)}{\partial(r,\theta)}$.
5. If $u = \frac{y^2}{x}, v = \frac{x^2}{y}$, find $\frac{\partial(u,v)}{\partial(x,y)}$.
6. If u = $\sin^{-1}\left(\frac{x}{y}\right) + \tan^{-1}\left(\frac{y}{x}\right)$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 0$
7. If $u = \frac{y}{z} + \frac{z}{x}$ then find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = ?$
8. If **u = x+y** and **y = uv**, find the Jacobian $\frac{\partial(x,y)}{\partial(u,v)}$.
9. Write down Taylor's formula.
10. Find dy/dx when $x^2+y^2 = xy$.
11. Are $u = x + y$ and $v = x - y$ functionally independent? Justify the claim.
12. If $x = r\cos\theta, y = r\sin\theta$, then find $\frac{\partial r}{\partial x}$ **(Jan-18)**
13. If x= $uv, y = \frac{u}{v}$, find $\frac{\partial(x,y)}{\partial(u,v)}$. **(Jan-18)**
14. Find $\frac{\partial u}{\partial x}$ and $\frac{\partial u}{\partial y}$ if $u = y^x$
15. If $u = (x-y)(y-z)(z-x)$, prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$.
16. If u= $(x-y)^4 + (y-z)^4 + (z-x)^4$ show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$
17. Find $\frac{du}{dt}$ if u = $\frac{x}{y}$ where $x = e^t$, y = log t
18. Find $\frac{du}{dx}$ **if** $u = \sin(x^2 + y^2)$, **where** $3x^2 + y^3 = 4$
19. If $x = u^2 - v^2$, $y = 2uv$ evaluate the Jacobian of **x, y** with respect to **u, v** **(Apr19)**
20. If $x^2 + y^2 = 1$, then find $\frac{dy}{dx}$.

21. Find $\frac{dy}{dx}$ if $x^y + y^x = c$, where **c** is a constant **(Nov18)**

22. State the properties of jacobians **(Nov18)**

23. Find $\frac{du}{dt}$ in trems of t , if $x^3 + y^3 = u$ where $x = at^2, y = 2at$ **(Apr19)**

PART – B

Implicit functions

1. If u = $\sin^{-1}\left(\frac{x^3 - y^3}{x + y}\right)$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2tanu.$

2. If g= $\Psi(u, v)$ *where* $u = x^2 - y^2$ *and* $v = 2xy$,

   show that $\frac{\partial^2 g}{\partial x^2} + \frac{\partial^2 g}{\partial y^2} = 4(x^2 + y^2)\left[\frac{\partial^2 \Psi}{\partial u^2} + \frac{\partial^2 \Psi}{\partial v^2}\right]$

3. If $u = f(x - y, y - z, z - x)$ *then show that* $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0.$

4. If $\emptyset = \emptyset(u, v)$ *where* $u = e^x \cos y, v = e^x \sin y$

   Show that $\frac{\partial^2 \emptyset}{\partial x^2} + \frac{\partial^2 \emptyset}{\partial y^2} = (u^2 + v^2)\left[\frac{\partial^2 \emptyset}{\partial u^2} + \frac{\partial^2 \emptyset}{\partial v^2}\right].$

5.If u = $\tan^{-1}\left(\frac{x^3 + y^3}{x - y}\right)$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = sin2u.$

6. If $u = x^2 \tan^{-1}\frac{y}{x} - y^2 \tan^{-1}\frac{x}{y}$, 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.

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

8. If $u = (x^2 + y^2 + z^2)^{-1/2}$ then find the value of $u_{xx} + u_{yy} + u_{zz}$. **(Jan-18)**

9. If $u = f\left(\frac{y-x}{xy}, \frac{z-x}{xz}\right)$ *find* $x^2\frac{\partial u}{\partial x} + y^2\frac{\partial u}{\partial y} + z^2\frac{\partial u}{\partial z}$. **(Nov-18)**

10. If $u = f(2x - 3y, 3y - 4z, 4z - 2x)$ then find $\frac{1}{2}\frac{\partial u}{\partial x} + \frac{1}{3}\frac{\partial u}{\partial y} + \frac{1}{4}\frac{\partial u}{\partial z}$ **(Apr19)**

Maxima and minima

11. Find the Maximum and Minimum of $f(x, y) = x^2 - xy + y^2 - 2x + y$.
12. Find the Maximum and Minimum of $f(x, y) = x^3 + y^3 - 3x - 12y + 20$.
13. Find the Maximum and Minimum of $f(x, y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$. **(Nov-18)**
14. Examine $f(x, y) = x^3 - 15y^2 - 15x^2 + 3xy^2 + 72x$ for extreme values. **(Apr19)**

Jacobian

15. *If* $y_1 = \frac{x_2 x_3}{x_1}, y_2 = \frac{x_3 x_1}{x_2}, y_3 = \frac{x_1 x_2}{x_3}$ *then find* $\frac{\partial(y_1, y_2, y_3)}{\partial(x_1, x_2, x_3)}$.

16. If $x + y + z = u, y + z = uv, z = uvw$, prove that $\frac{\partial(x,y,z)}{\partial(u,v,w)} = u^2 v.$

17. Find the maximum and minimum values of $f(x, y) = 3x^2 - y^2 + x^3$. **(Jan-18)**

Lagrange's multiplier method

18. A rectangular box open at the top is to have a volume of 32cc. Find the dimensions of the box requiring, the least material for the construction.

19. The temperature at any point (x, y, z) in space is $T = 400xyz^2$. Find the highest temperature on the surface of the unit sphere $x^2 + y^2 + z^2 = 1$.

20. Find the shortest and the longest distances from the point (1,2,-1) to the spher $x^2 + y^2 + z^2 = 24$. **(Apr19)**

21. Find the dimensions of the rectangular box without a top of maximum capacity, whose surface area is 108 sq. cm. **(Jan-18)**

22. Find the volume of the greatest rectangular parallelepiped 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.

23. Find the shortest distances from the point $(1, 2, 0)$ to the cone $x^2 + y^2 = z^2$. **(Nov-18)**

<u>Taylor's series method</u>

24. Expand $f(x, y) = e^x \cos y$ at $\left(0, \frac{\pi}{2}\right)$ upto 3rd term using Taylor's series.

25. Obtain the Taylor's series expansion of $x^3 + y^3 + xy^2$ in terms of power of (x-1) and (y-2) upto third degree terms. **(Jan-18)**

26. Find the taylor's series of function $f(x) = \sqrt{1 + x + y^2}$ in powers $(x - 1)$ and y upto second degree terms. **(Nov-18)**

27. Expand Taylor's series expansion of $x^2y^2 + 2x^2y + 3xy^2$ in terms of power of $(x + 2)$ and $(y - 1)$ upto third degree terms. **(Apr19)**

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UNIT III – INTEGRAL CALCULUS

PART – A

1. Find the derivative of $g(x) = \int_0^x \sqrt{1+t^2}\,dt$.
2. Find the derivative of $g(x) = \int_a^x (t^3+1)dt$.
3. Evaluate $\int_{-1}^{2}(x^3-2x)dx$ using Fundamental theorem of calculus.
4. Evaluate $\int_1^4 (5-2t+3t^2)dt$ using Fundamental theorem of calculus.
5. Evaluate $\int e^{x^3}x^2dx$.
6. Evaluate $\int e^{cosx}sinxdx$.
7. Evaluate $\int xsinxdx$.
8. Evaluate $\int te^t dt$.
9. Write down reduction formula of $\int_0^{\frac{\pi}{2}} \sin^n x\ dx$.
10. Evaluate the improper integral $\int_0^\infty \frac{1}{x}dx$.
11. Evaluate $\int \cos^2 x\,dx$.
12. Evaluate $\int \frac{1}{\sqrt{a^2-x^2}}\ dx$.
13. What is wrong with the equation $\int_{-1}^{2} \frac{4}{x^3}dx = \left[\frac{-2}{x^2}\right]_{-1}^{2} = \frac{3}{2}$? **(Jan-18)**
14. Evaluate $\int_4^\infty \frac{1}{\sqrt{x}}dx$ and determine whether it is convergent or divergent. **(Jan-18)**
15. Use the properties of integrals to evaluate $\int_0^4 (4+3x^2)dx$.
16. Write the substitution rule and solve $\int \frac{x}{\sqrt{1-4x^2}}dx$.
17. Determine whether $\int_0^{\pi/2} secxdx$ converges or diverges.
18. Define improper integral for discontinuous integrands.

19. Determine whether the integral $\int_1^{\infty} \frac{1}{x^2} dx$ is convergent or divergent.

20. Evaluate $\int \frac{1}{x\sqrt{x+9}} dx$.

21. State the fundamental theorem of calculus. **(Nov18)**

22. If f is continuous and $\int_0^4 f(x)dx = 10$, find $\int_0^2 f(2x)dx$ **(Nov18)**

23. Evaluate $\int \frac{1}{1+tanx} dx$. limits **0 to** $\frac{\pi}{2}$ **(Apr19)**

24. Evaluate $\int_3^{\infty} \frac{dx}{(x-2)^{\frac{3}{2}}}$ and determione whether it is convergent or divergent. **(Apr19)**

PART – B

Definite integrals

25. Evaluate $\int_0^3 (x^2 - 2x)dx$ by using Riemann sum by taking right end points as the sample points.

26. Prove that $\int_a^b x dx = \frac{b^2-a^2}{2}$ by using Riemann sum by taking right end points as the sample points.

Indefinite integrals

27. Evaluate $\int \frac{\tan x}{\sec x + \cos x} dx.$ **(Jan-18)**

28. Evaluate $\int_0^{\frac{\pi}{2}} \frac{sinx\ cosx}{cos^2x+3cosx+2} dx$ **(Apr19)**

29.Evaluate $\int_0^{\pi/2} \cos^5 x dx$. **(Jan-18)**

30. Evaluate the integrals 1) $\int x^3 \cos(x^4+2)dx$ 2) $\int_1^2 \frac{1}{(3-5x)^2} dx$

31. Evaluate $\int_0^{\frac{\pi}{4}} x\ tan^2\ x\ dx$ **(Apr19)**

Substitution methods

32. Find $\int \sin^n x\, dx$ using reduction formula and evaluate $\int_0^{\frac{\pi}{2}} \sin^n x\, dx$. **(Nov18)**

33. Evaluate $\int e^{ax} \cos bx dx$. using integration by parts. **(Jan-18)**

34. Evaluate $\int e^{-ax} sinbx\ dx\ (a > 0)$ using integration by parts. **(Apr19)**

35. Evaluate $\int (log\ x)^2\ dx$ using integration by parts

36. Evaluate $\int e^x sinx dx$.

37. Evaluate $\int \tan^{-1} x\, dx$.Also find $\int_0^1 \tan^{-1} x\, dx$

38. Evaluate $\int e^{\tan^{-1} x} \left(\frac{1+x+x^2}{1+x^2}\right) dx$.

39. Evaluate $\int \frac{(log\ x)^2}{x^2} dx$ using integration by parts. **(Nov18)**

40. Evaluate $\int \tan^{-1} x\, dx$. Also find $\int_0^1 \tan^{-1} x\, dx$.

Improper integrals

41. For what values of 'p' is the integral $\int_1^{\infty} \frac{1}{x^p} dx$ convergent? **(Nov18)**

42. Determine whether the integral $\int_1^{\infty} \frac{\log x}{x^2} dx$ is convergent or divergent.

Partial fraction method

43. Evaluate $\int \frac{10}{(x-1)(x^2+9)} dx$.

44. Evaluate $\int \frac{x^4-2x^2+4x+1}{x^3-x^2-x+1} dx$.

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

Integral of the form

46. Evaluate $\int (3x-2)\sqrt{x^2+x+1}\, dx$

47. Evaluate $\int_{\frac{\sqrt{2}}{3}}^{\frac{2}{3}} \frac{1}{x^5\sqrt{9x^2-1}} dx$ **(Nov18)**

48. Evaluate $\int \frac{x}{\sqrt{x^2+x+1}} dx$. **(Jan-18)**

49. Evaluate $\int \frac{2x+5}{\sqrt{x^2-2x+10}} dx$ **(Apr19)**

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UNIT IV – MULTIPLE INTEGRAL

PART – A

1.Sketch the region of integration of the of the integral $\int_0^1 \int_0^x f(x,y)\,dydx$ and change the order of integration.

2. Sketch the region of integration of the of the integral $\int_0^{\infty} \int_0^{y} y e^{-y^2/x}\, dxdy$ and change the order of integration.

3. Evaluate integral $\int_0^1 \int_1^2 x(x+y)\, dydx$.

4. Evaluate integral $\int_0^{\frac{\pi}{2}} \int_0^{sin\theta} r\, d\theta dr$.

5. Evaluate integral $\int_0^{\pi} \int_0^{a} r\, d\theta dr$.

6. Evaluate integral $\int_1^2 \int_1^3 \frac{dxdy}{xy}$.

7. Evaluate the triple integral $\int_0^1 \int_0^2 \int_0^3 e^{x+y+z} dzdxdy$.

8. Evaluate the triple integral $\int_0^{\pi} \int_0^{\frac{\pi}{2}} \int_0^1 r^2 sin\theta\, drd\theta d\varphi$.

9. Change the order of integration in $\int_0^1 \int_{x^2}^{2-x} f(x,y)\,dydx$.

10. Evaluate the triple integral $\int_0^1 \int_0^y \int_0^{x+y} dzdxdy$.

11. Find the value of $\int_0^{\infty}\int_0^{y} \left(\frac{e^{-y}}{y}\right) dxdy$ **(Jan-18)**

12. Find the limits of the integration in the double integral $\iint_R f(x,y)\,dxdy$ where R is in the first quadrant and bounded by x=1, y=0, y^2=4x. **(Jan-18)**

13. Evaluate $\int_0^3\int_0^2 e^{x+y}\,dydx$

14. Find the area bounded by the lines x= 0, y =1 and y = x using double integration.

15. Sketch the region of integration in $\int_0^1\int_0^x dxdy$

16. Transform into polar co-ordinates the integral $\int_0^a \int_y^a f(x,y)dxdy$.

17. Transform into polar co-ordinates the integral $\int_0^\infty \int_0^\infty f(x,y)dydx$

18. Write down the double integral to find area between the circles $r = 2\sin\theta$ and $r = 4\sin\theta$

19. Evaluate $\int_0^a \int_0^b (x+y)dxdy$

20. Evaluate $\int_0^4 \int_0^{x^2} e^{y/x}\, dydx$

21. Evaluate $\int_1^{log8} \int_0^{logy} e^{x+y}\, dx\, dy$ **(Nov18)**

22. Change the order of integration in $\int_0^1 \int_{y^2}^{y} f(x,y)\, dxdy$ **(Nov18)**

23. Evaluate $\int_1^a \int_2^b \frac{1}{xy}\, dxdy$ **(Apr19)**

24. Find the limits of integraton $\iint f(x,y)\, dxdy$ bounded by $x = 0, y = 0, x + y = 2$ **(Apr19)**

PART – B

Double Integrals

1. Evaluate $\iint xydxdy$ over the region in the positive quadrant bounded by $\frac{x}{a}+\frac{y}{b}=1$ **(Apr19)**

2. Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\, dx\, dy$ using polar coordinates

Change of Order of Integration

3. Evaluate integral $\int_0^1 \int_y^{2-y} xy\, dxdy$ by changing the order of integration.

4. Evaluate integral $\int_0^a \int_0^{2\sqrt{ax}} x^2 dydx$ by changing the order of integration. **(Jan-18)**

5. Evaluate integral $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y}\, dydx$ by changing the order of integration **(Apr19)**

6. By changing the order of integration, evaluate $\int_0^1 \int_y^1 \frac{x}{x^2+y^2} dxdy$

7. Change the order of integration in the integral $\int_0^1 \int_{x^2}^{2-x} xy\, dx\, dy$

Area as Double Integral

8. Find the area which is inside the circle $r = a\sin\theta$ but lying outside the cardioids $r = a(1-\cos\theta)$

9. Find by double integral, the area enclosed by the curves $y^2 = 4ax$ and $x^2 = 4ay$

10. Find the area of the Ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$

11. Find the area which is inside the circle $r = a\sin\theta$ but lying outside the cardioids $r = a(1-\cos\theta)$

12. Find by double integral, the area enclosed by the curves y=x and y=x^2 **(Jan-18)**

13. Evaluate $\iint xy(x+y)dxdy$ over area between y=x and y=x^2 **(Nov18)**

14. Find the area bounded by the parabolas $y^2 = 4 - x$ and $y^2 = x$ **(Nov18)**

Triple Integration

15. Evaluate $\iiint x^2 yz\,dx\,dy\,dz$ taken over the tetrahedron bounded by the planes x=0,y=0,z=0 and $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$

16. Evaluate $\iiint_V \frac{1}{(x+y+z+1)^3}\,dx\,dy\,dz$ where V is the region bounded by $x=0, y=0, z=0, x+y+z=1$.

17. Evaluate $\iiint xyzdxdydz$ over the first octant of $x^2+y^2+z^2=a^2$ **(Jan-18)**

18.Evaluate $\int_0^{\log 2}\int_0^{x}\int_0^{x+\log y} e^{x+y+z}\,dz\,dy\,dx$

19. Evaluate $\iiint xyzdxdydz$ through the positive spherical octant for which $x^2+y^2+z^2 \le a^2$ **(Apr19)**

Change of Variables

20. Evaluate by changing into polar coordinates the integral $\int_0^a\int_y^a \frac{x}{x^2+y^2}\,dxdy$ **(Jan-18)**

21. Transform the integral into polar coordinates and hence evaluate $\int_0^a\int_0^{\sqrt{a^2-x^2}} \sqrt{x^2+y^2}\,dy\,dx$

22. Evaluate $\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}\,dxdy$ by changing to polar co-ordinates and hence

find the value of $\int_0^\infty e^{-x^2}dx$.

23. Express $\int_0^a\int_y^a \frac{x^2}{\left(x^2+y^2\right)^{\frac{3}{2}}}\,dxdy$ in polar coordinates and then evaluate it **(Nov18)**

24. Evaluate by changing into polar coordinates the integral $\int_0^a\int_y^a \frac{x}{\sqrt{x^2+y^2}}\,dxdy$ **(Apr19)**

Volume

25. Using triple integration, find the volume of the sphere $x^2+y^2+z^2=a^2$

26. Find the volume of the tetrahedron bounded by the plane $x+y+z=1$ and the coordinate plane.

27. Evaluate $\iiint dxdydz$ where V is the finite region of space bounded by the planes $x=0, y=0, z=0$ and $2x+3y+4z=12$.(tetrahedron) **(Nov18)**

ST.ANNE'S

COLLEGE OF ENGINEERING AND TECHNOLOGY

(An ISO 9001:2015 Certified Institution)

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QUESTION BANK

PERIOD: AUG - DEC 2019 **BATCH**: 2019 – 2023

BRANCH: COMMON **YEAR/SEM:** I/01

SUB CODE/NAME: MA8151 ENGINEERING MATHEMATICS – I

UNIT V – ORDINARY DIFFERENTIAL EQUATIONS

PART – A

1. Solve $(D^2+5D+6)y=0$.
2. Solve $(D^2+4D+6)y=0$.
3. Find the Particular integral of $(D^2-4)y=e^{-4x}$.
4. Find the Particular integral of $(D^3+4D)y=sin2x$.
5. Solve $(D^2+1)y=0$.
6. Solve $(D^2+6D+9)y=0$.
7. Find the particular integral of $(D^2+4)y=cos2x$.
8. Find the particular integral of $(D^2-4)y=e^{-4x}$.
9. Reduce $(\boldsymbol{x^2D^2-3xD+3)y=x}$ into a differential equation with constant coefficient.
10. Reduce $(\boldsymbol{x^2D^2+xD+1)y=0}$ into a differential equation with constant coefficient.
11. Reduce $(\boldsymbol{(2x+3)^2D^2-(2x+3)D-12))y=6x}$ into a differential equation with constant coefficient.
12. Find the particular integral of $\boldsymbol{y''-6y'+9y=2e^{3x}}$.
13. Find the particular integral of $(D-1)^2y=e^x\sin x$ **(Jan-18)**
14. Convert $x^2y''-2xy'+2y=0$ into a linear differential equation with constant coefficients. **(Jan-18)**
15. Solve $(\mathrm{D}^2+6D+9)\,\mathrm{y}=0$
16. Find the particular integral of $\left(D^2-2D+1\right)y=\cosh x$
17. Solve $x^2\dfrac{d^2y}{dx^2}+4x\dfrac{dy}{dx}+2y=0$
18. Transform the differential equation $\left(x^2D^2+4xD+2\right)y=x+\dfrac{1}{x}$ into a differential equation with constant coefficient.
19. Transform the equation $(2x-1)^2y''-4(2x-1)y'+8y=8x$ into the linear equation with constant coefficients.
20. Find the differential equation of x(t) given $\dfrac{dy}{dt}+x=\cos t,\dfrac{dx}{dt}+y=e^{-t}$
21. Solve $(D^3+1)y=0$. **(Nov18)**
22. Transform the equation $xy''+y'+1=0$ into the linear equation with constant coefficients **(Nov18)**

23. Find P.I of $(D-a)^2y = e^{ax}sinx$ **(Apr19)**

24. Solve $x^2y''xy' + y = 0$ **(Apr19)**

PART – B

Homogeneous equations

1. Solve the differential equation $(D^2 + 3D + 2)y = e^{-3x}$.

2. Solve the differential equation $(D^2 - 4D + 4)y = e^{2x} + cos2x$.

3. Solve the differential equation $(D^2 - 3D + 2)y = sin3x$.

4. Solve the differential equation $(D^2 - 5D + 6)y = x^2 + 3$.

5. Solve the differential equation $(D^2 + 5D + 4)y = e^{-x}sin2x$.

6. Solve the differential equation $(D^2 + 2D + 1)y = e^{-x}x^2$.

7. Solve the differential equation $(D^2 + 4)y = xsinx$.

8. Solve the differential equation $(D^2 + 4D + 5)y = e^x + x^2 + cos2x + 1$. **(Nov18)**

Euler's and Legendre's equations

9. Solve $(x^2D^2 + 4xD + 2)y = logx$.

10. Solve $((x+1)^2D^2 + (x+1)D + 1)y = 4\cos[\log(x+1)]$. **(Jan-18)**

11. Solve $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 2\sin(\log(1+x))$

12. Solve $(x^2D^2 - 2xD - 4)y = x^2 + 2\log x$

13. Solve $(x^2D^2 - xD + 1)y = \left[\frac{logx}{x}\right]^2$ **(Nov18)**

14. Solve $(2+x)^2\frac{d^2y}{dx^2} - (2+x)\frac{dy}{dx} + y = 3x + 4$ **(Apr19)**

Variation of parameter

15. Solve $(D^2 + 1)y = cosecx$.

16. Solve $(D^2 + a^2)y = tanax$. **(Apr19)**

17. Solve $(D^2 + 4)y = sec2x$.

18. Solve the equation $(D^2+1)y = x\sin x$ by the method of variation of parameters.

19. Solve $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + 4y = x^2\sin(\log x)$

20. Solve $y'' - 4y' + 4y = (x+1)e^{2x}$ **(Nov18)**

Simultaneous equations

21. Solve the simultaneous equations Dx+y=sin2t and –x+Dy=cos2t. **(Jan-18)**

22. Solve $\frac{dx}{dt} + 4x + 3y = t; \frac{dy}{dt} + 2x + 5y = e^{2t}$

23. Solve $\frac{dx}{dt} + 5x - 2y = t; \frac{dy}{dt} + 2x + y = 0$

24. Solve the simultaneous equation $\frac{dx}{dt} - y = t$ and $\frac{dy}{dt} + x = t^2$ given $x(0) = y(0) = 2$.

25. Solve $\frac{dx}{dt} - \frac{dy}{dt} + 2y = cos2t$, $\frac{dx}{dt} - 2x + \frac{dy}{dt} = sin2t$ **(Nov18)**

26. Solve $\frac{dx}{dt} + \frac{dy}{dt} + 3x = sint$, $\frac{dx}{dt} + y - x = cost$ **(Apr19)**

27. Solve $(D^2 + 2D + 1)y = e^x sin2x$ by using the method of undetermined coefficients. **(Apr19)**

28. Solve $(D^2 - 2D)y = 5\, e^x cosx$ by using the method of undetermined coefficients **(Nov18)**