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2nd Semester Math exam

Suggestion

on

Integral Calculus and Differential Equation

Prepared by

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Rajib 20/2/18

[1.33 AM]

Reference Book—

Integral calculus and Differential Equation

writer → Dr. Abdul Matin.

Integral Calculus

$$[chapter - 2+3+4+5+6+7+7(A) \rightarrow 20 \text{ marks}]$$

chapter - 2

i) $\int \dfrac{(1+x)e^x \, dx}{\cos^2(xe^x)}$

ii) $\int \cos 2\cot^{-1}\sqrt{\dfrac{1-x}{1+x}} \, dx$

iii) $\int \dfrac{dx}{\sqrt[3]{x}\,\sqrt[3]{(1+x)^5}}$

chapter - 3

i) $\int e^{2x}\left(\dfrac{1+\sin 2x}{1+\cos 2x}\right) dx$

ii) $\int \dfrac{e^{m\tan^{-1}x}}{(1+x^2)^2} \, dx$

iii) $\int \cos^{-1}\sqrt{\dfrac{x}{a+x}} \, dx$

chapter - 4

i) $\int \dfrac{7x-9}{x^2-2x+35} \, dx$

chapter - 5

i) $\int \dfrac{dx}{(x^2+1)\sqrt{x^2+4}}$

ii) $\int \dfrac{dx}{(1+x^2)\sqrt{1-x^2}}$

iii) $\int \sqrt{4+3x-2x^2} \, dx$

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chapter - 6

i) $\int \dfrac{dx}{(x-1)^2 (x^2+4)}$

ii) $\int \dfrac{x^2 dx}{(x+1)(x-2)(x+3)}$

iii) $\int \dfrac{dx}{(x^2+4x+5)^2}$

iv) $\int \dfrac{x^2 \, dx}{x^4+x^2-5}$

chapter - 7

i) $\int \dfrac{d\theta}{3\sin\theta + 2\cos\theta + 5}$

ii) $\int \dfrac{dx}{3+2\sin x}$

chapter - 7(A)

i) $\int \dfrac{\sin^3 x}{\cos^9 x} dx$

ii) $\int \sin^5 x \, \cos^3 x \, dx$

iii) $\int \dfrac{dx}{\sqrt[3]{\cos x} \, \sqrt[3]{\sin^5 x}}$

iv) $\int \dfrac{dx}{\sin^{1/4} x \, \cos^{7/4} x}$

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Chapter $-9+10+11+14(B)+12 \rightarrow 20$ marks

Chapter -9

i) $\int_0^{16} \frac{x^{1/4}}{1+\sqrt{x}} \, dx$

ii) $\int_0^{\pi/2} \frac{dx}{a^2 \sin^2 x + b^2 \cos^2 x}$

iii) $\int_0^a \frac{a^2 - x^2}{(a^2 + x^2)^2} \, dx$

iv) $\int_0^3 \frac{dx}{(16 + x^2)^{3/2}}$

v) $\int_0^\alpha \frac{(\tan^{-1} x)^2}{1 + x^2} \, dx$

vi) $\int_0^{\pi/2} \frac{dx}{a + b \cos x} \, ; \, a > b > 0$

Chapter -10

i) $\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} \, dx$

ii) $\int_0^{\pi/2} \frac{\sqrt{\tan x}}{1 + \sqrt{\tan x}} \, dx$

iii) $\int_0^{\pi/2} \ln(\sin x) \, dx$

iv) $\int_0^{\pi/2} \frac{\cos x}{\sin x + \cos x} \, dx$

Chapter -11

i) $\int_0^{\pi/2} \sin^4 x \, \cos^2 x \, dx$

3

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Chapter— 14(B)

~~1. If $I_n = \int_0^{\pi/4} \text{~~~~~} \tan^m x\,dx$ then prove that~~

~~I_n.~~

1. If $I_n = \int_0^{\pi/4} \tan^n x\,dx$ then prove that

$$I_n + I_{n+2} = \frac{1}{n-1}$$

Chapter—12

1. Define definite integral as a limit of Sum.

2. Evaluate —

    i) $\int e^x\,dx$ as a limit of a sum

    ii) $\int e^{-x}\,dx$ as a limit of a sum

3. Evaluate —

    i) $\lim\limits_{n \to \alpha} \left[\frac{1}{n} + \frac{1}{\sqrt{n^2 - 1^2}} + \frac{1}{\sqrt{n^2 - 2^2}} + \cdots + \frac{1}{\sqrt{n^2 - (n-1)^2}} \right]$

    ii) $\lim\limits_{n \to \alpha} \left[\frac{1}{n} + \frac{n^2}{(n+1)^3} + \frac{n^2}{(n+2)^3} + \cdots + \frac{1}{8n} \right]$

    iii) $\lim\limits_{n \to \alpha} \frac{1}{n} \left[(n+1)(n+2)(n+3) \cdots \cdots (n+n) \right]^{\frac{1}{n}}$

    or, $\lim\limits_{n \to \alpha} \left[(1 + \frac{1}{n})(1 + \frac{2}{n})(1 + \frac{3}{n}) \cdots (1 + \frac{n}{n}) \right]^{\frac{1}{n}}$

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iv) $\displaystyle \lim_{n \to \alpha} \left[\frac{n^2}{n^3} + \frac{n^2}{(n+1)^3} + \frac{n^2}{(n+2)^3} + \cdots + \frac{n^2}{(n+n)^3} \right]$

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Differential Equation

chapter-1+2+3+4+5+6 → 20 marks

chapter-2

1. Define ODE, PDE and GS, LDE with example.

2. Define order and degree of differential equation.

3. Find order and degree —

   i) $\dfrac{d^2y}{dx^2} = K\left[1 + \left(\dfrac{dy}{dx}\right)^2\right]^{5/2}$

   ii) $\left[1 + \left(\dfrac{dy}{dx}\right)^2\right]^{2/3} = \dfrac{d^2y}{dx^2}$

4. Find the differential equation of the curve $y = (A\cos 2x + B\sin 2x)e^x$ where A and B are constant.

5. Obtain the differential equation of which $y = A\cos\alpha x + B\sin\alpha x$ is a solution where A and B are constant and α is a

⑥

fixed constant.

6. From a differential equation of curve $xy = ae^x + be^{-x} + x^2$, where a

7. Initially there were 100 milligrams of a radioactive substance present. After 6 hours, the mass is decreased by 3%. If the rate of decay is proportional to the amount of the substance present at any time, find the amount of substance remai-ing after 24 hours. Also determine the half-life of the radioactive substance

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chapter — 2

1. $\frac{dy}{dx} = \sin(x+y) + \cos(x+y)$

2. $\sqrt{1+y^2}\ dx + \sqrt{1-x^2}\ dy = 0$

3. $x\sqrt{1-y^2}\ dx + y\sqrt{1-x^2}\ dy = 0$

4. $y\sqrt{x^2-1}\ dx + \sqrt{y^2-1}\ dy = 0$

chapter — 3

1. $\left(y + \sqrt{x^2+y^2}\right)dx - x\,dy = 0$

2. $x(x+y)\,dy = y(x-y)\,dx$

3. $(x^2+y^2)\,dx - 2xy\,dy = 0$

4. $(x^3 - 3xy^2)\,dx + (y^3 + 3x^2y)\,dy = 0$

5. $\frac{dy}{dx} = \frac{y}{x} + \tan\frac{y}{x}$

Chapter — 4

1. $(x+y-1)\,dy = (x+y+1)\,dx$

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chapter - 5

1. $\left(1 + e^{x/y}\right) dx + e^{x/y}\left(1 - \frac{x}{y}\right) dy = 0$

2. $(4x + 3y + 1) dx + (3x + 2y + 1) dy = 0$

3. $(x^2 + y^2 + x) dx + xy\, dy = 0$

chapter - 6

1. $\cos^2 x \dfrac{dy}{dx} + y = \tan x$

2. $x\left(\dfrac{dy}{dx}\right) - 3y = x^2$

3. $\dfrac{dy}{dx} = y \tan x + y^3 \tan x$

4. $(1 - x^2) \dfrac{dy}{dx} - xy = 1$

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chapter- 7 + 8 + 9 + 10 + 11 → 20 or 12 marks

chapter - 7

1. $(D^4 - 4D^3 + D^2 + 12D - 12)y = 0$

2. Find the particular solution of

$\dfrac{d^2y}{dx^2} + 3\dfrac{dy}{dx} + 2y = 0$ when $y(0) = 0$

and $y'(0) = 1$

3. find the particular solution of the following equation —

$\dfrac{d^2y}{dx^2} - 2\dfrac{dy}{dx} + 10y = 0$, when $y(0) = 1$,

$y'(0) = 4$

4. Solve $(D^2 - 2D - 8)y = 0$ when $x = 0$

then $y = 0$ and $y' = 24$

5. Solve $\dfrac{d^2y}{dx^2} + \dfrac{dy}{dx} - 2y = 0$ when $x = 0$

then $y = 3$ and $\dfrac{dy}{dx} = 0$

[এই গুলি math গুলোকে এই chapter-এর ভেতর math সুলোও রুনা(র]

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chapter-8

1. $(D^2 - 4D + 4)y = x$

2. $(D^2 - 6D + 9)y = 1 + x + x^2$

3. $(D^3 + 3D^2 + 3D + 1)y = x^2$

[বি.দ্র: এই তিনটা math বুঝলে এই chapter-এর অন্য math গুলোও বুঝবে]

chapter-9

i) $(D^3 - 6D^2 + 11D - 6)y = e^{2x}$

ii) $\dfrac{d^3y}{dx^3} - 3\dfrac{d^2y}{dx^2} + 4y = e^{3x}$

iii) $(D^2 - 3D + 2)y = e^{5x}$

[বি.দ্র: এই তিনটা math বুঝলে এই chapter এর অন্য math গুলোও বুঝবে]

chapter-10

~~1. $(D^3 - D^2 + 4D - 4)y = 68\,e^x \sin 2x$~~

1. $(D^2 + 4)y = \sin 2x \sin x$

2. $(D^3 - D^2 - D - 1)y = \cos 2x$

3. $(D^2 + 1)y = \sin 2x \sin x$

[বি.দ্র: এই তিনটা math বুঝলে এই chapter-এর অন্য math গুলোও পারবে]

chapter - 11

1. $(D^3 - D^2 + 4D - 4)y = 68e^x \sin 2x$

2. $(D^2 - 9)y = e^{3x} \cos x$

3. $(D^2 - 2D)y = e^x \sin x$

[এই তিনটা math বুঝলে, এই chapter-এ অন্য math সমাধান করতে পারবে]