



**INDIAN INSTITUTE OF MANAGEMENT & COMMERCE
DEGREE & P.G COLLEGE, (An Autonomous College)**

Sponsored by VASAVI FOUNDATION & Affiliated to OSMANIA UNIVERSITY

RE-ACCREDITED BY NAAC WITH "A+" GRADE

An ISO 21001 : 2018 Certified College

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B.Sc – I , Semester –I

Subject : Mathematics

Paper : Differential Equations

Question Bank

Unit – I

I. Short Answer questions.

1. Solve $3e^x \tan y \, dx + (1 - e^x) \sec^2 y \, dy = 0$
2. Solve $(xy^2 + x)dx + (yx^2 + y)dy = 0$
3. Solve $\frac{dy}{dx} = xy + x + y + 1$
4. Solve $\frac{dy}{dx} = (4x + y + 1)^2$
5. Solve $(1 + x) \frac{dy}{dx} - xy = 1 - x$
6. Solve $y \, dx - x \, dy + \log x \, dx = 0$
7. Solve $\sin 2x \frac{dy}{dx} - y = \tan x$
8. Solve $x \frac{dy}{dx} + 2y = x^2 \log x$
9. Solve $\frac{dy}{dx} + \frac{ax+hy+g}{hx+by+f} = 0$
10. Solve $(x^2 - 2xy - y^2)dx - (x + y)^2 dy = 0$

II. Long answer questions.

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

4. Solve $x^2y \, dx - (x^3 + y^3)dy = 0$
5. Solve $(2x - y + 1)dx + (2y - x - 1)dy = 0$
6. Solve $(2x + 4y + 3) \frac{dy}{dx} = (x + 2y + 1)$
7. Solve $x \frac{dy}{dx} + y = y^2 \log x$
8. Solve $\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y$
9. Solve $\frac{dy}{dx} + \frac{y}{x} = y^2 \sin x$
10. Solve $(xy + 2x^2y^2)y \, dx + (xy - x^2y^2)x \, dy = 0$

Unit -II

I. Short answer questions.

1. Solve $y + px = x^4p^2$
2. Solve $y = \sin p - p \cos p$
3. Solve $y = yp^2 + 2px$
4. Solve $p^2 - 7p + 12 = 0$
5. Solve $y^2 \log y = xyp + p^2$
6. Solve $xp^3 = a + bp$
7. Solve $x = y + a \log p$
8. Solve $(y - px).(p - 1) = p$
9. Solve $p = \log(px - y)$
10. Solve $y = 2px + \tan^{-1}(xp^2)$

II. Long answer questions.

1. Solve $p^2 + 2py \cot x = y^2$
2. Solve $x^2p^2 + xyp - 6y^2 = 0$
3. Solve $x^2p^3 + y(1 + x^2y)p^2 + y^3p = 0$
4. Solve $xy^2(p^2 + 2) = 2py^3 + x^3$

5. Solve $y = yp^2 + 2px$

6. Solve $x^2p^2 + yp(2x + y) + y^2 = 0$ by reducing it to clairaut's form by using the substitution $y = u$ and $xy = v$.

7. Bacteria in a certain culture increase at a rate propotional to the number present . If the number N increases from 1000 to 2000 in 1 hour, how many are present at the end of 1.5 hours.

8. In a culture of yeast , the amount A of active yeast grows at a rate propotional to the amount present .If the original amount A_0 doubles in 2 hours , how long does it take for the original amount to triple ?

9. Bacteria in a certain culture increase at a rate propotional to the number present . If the number doubles in one hour , how long does it take for the number to triple ?

10. It is found that 0.5 percent of radium disappears in 12 years . a) What percentage will disappear in 1000 years ? b) What is the half- life of radium ?

11. If Rs. 10,000 is invested at 6 percent per annum , find what amount has accumulated after 6 years if interest is comounded. A) annually, b) quarterly , c) Continuously.

12. How long does it take for a given amount of money to double at 6 percent annum compounded. a) annually, b) Continuously.

Unit -3

I. Short answer questions.

1. Solve $\frac{d^3y}{dx^3} + 6 \frac{d^2y}{dx^2} + 11 \frac{dy}{dx} + 6y = 0$

2. Solve $\frac{d^3y}{dx^3} - 3 \frac{dy}{dx} + 2y = 0$

3. Solve $\frac{d^2y}{dx^2} + 4y = 0$

4. Solve $\frac{d^3y}{dx^3} + y = 0$

5. Solve $\frac{d^2y}{dx^2} - 2 \frac{dy}{dx} - 3y = 5$

6. Solve $(D^3 - D^2 - 4D + 4)y = e^{3x}$

7. Solve $(4D^2 - 4D + 1)y = e^{x/2}$

8. Solve $(D^2 - 3D + 2)y = 3 \sin 2x$

9. Solve $(D^2 + 4)y = \cos 2x$

10. Solve $\frac{d^2y}{dx^2} + 2 \frac{dy}{dx} + y = x \cos x$

II. Long answer questions.

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

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

3. Solve $(D^3 - D^2 - 6D)y = x^2 + 1$

4. Solve $(D^2 - 2D + 5)y = e^{2x} \sin x$.

5. Solve $(D^2 - 4D + 4)y = 8(x^2 + e^{2x} + \sin 2x)$

6. Solve $(D^2 + 2)y = x \cdot e^{3x} + e^x \cos x$

7. Solve $(D^2 - 2D + 1)y = x \cdot e^x \sin x$

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

9. Solve $(D^2 + 4D + 4)y = 4x^2 + 6e^x$ by using method of undetermined coefficients.

10. Solve $(D^2 - 3D + 2)y = 2x^2 + 3e^{2x}$ by using method of undetermined coefficients.

11. Solve $(D^2 + 4D + 4)y = 3xe^{-2x}$ by using method of undetermined coefficients.

Unit- IV

I. Short answer questions.

1. Find the Solution of the equation $y'' - \frac{2}{x}y' + \frac{2}{x^2}y = 0$, Given one solution of homogeneous equation $y_1 = x$.

2. Solve $x^2 y'' - x y' + y = 0$, Given $y_1 = x$ as a solution.

3. Solve $x dx + z dy + (y + 2z)dz = 0$

4. Solve $\frac{dx}{z^2y} = \frac{dy}{z^2x} = \frac{dz}{y^2x}$

5. Solve $\frac{dx}{x(y^2 - z^2)} = \frac{dy}{-y(z^2 + x^2)} = \frac{dz}{z(x^2 + y^2)}$

6. Solve $(y + z)dx + (z + x)dy + (x + y)dz = 0$

7. Solve $\frac{dx}{mz-ny} = \frac{dy}{nx-lz} = \frac{dz}{ly-mx}$

8. Solve $\frac{dx}{y-zx} = \frac{dy}{yz+zx} = \frac{dz}{x^2+y^2}$

9. Solve $\frac{dx}{x(y^2-z^2)} = \frac{dy}{y(z^2-x^2)} = \frac{dz}{z(x^2-y^2)}$

10. Solve $\frac{dx}{x^2-y^2-z^2} = \frac{dy}{2xy} = \frac{dz}{2xz}$

II. Long answer questions.

1. Solve $(D^2 - 3D + 2)y = \sin e^{-x}$ by using method of variation of parameters.

2. Solve $(D^2 + 4D + 4)y = 3xe^{-2x}$ by using method of variation of parameters.

3. Solve $y'' + 3y' + 2y = 12e^x$ by using method of variation of parameters.

4. Solve $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - 4y = x^2$

5. Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = 2 \log x$

6. Solve $x^2 D^2 y - x dy - 3y = x^2 \log x$

7. Solve $x^3 D^3 y + 3x^2 D^2 y + x Dy + y = x + \log x$

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

9. Solve $(2x+3)^2 \frac{d^2y}{dx^2} - 2(2x+3) \frac{dy}{dx} - 12y = 6x$

10. Solve $(x+3)^2 \frac{d^2y}{dx^2} - 4(x+3) \frac{dy}{dx} + 6y = 6 \log(x+3)$.