



D. Y. Patil College of Engineering & Technology
Kasaba Bawada, Kolhapur 416006
(An Autonomous Institute)

Academic Year: 2023-24

Semester: II

Class: F.Y.B.Tech.

Course: Differential Equations and Numerical Techniques

Course Code: 231FYL111

Tutorial-I

Ordinary Differential Equations of First order and First Degree
(Exact Differential Equations and Reducible to Exact Differential Equations)

Course Outcomes (COs): After successfully completion of this tutorial, students will be able to	
111.1	Solve ordinary differential equations of first order and first degree

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



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Tutorial-II

Ordinary Differential Equations of First order and First Degree
(Linear Differential Equations and Reducible to Linear Differential Equations)

Course Outcomes (COs): After successfully completion of this tutorial, students will be able to	
111.1	Solve ordinary differential equations of first order and first degree

Q.1	Solve $\cos x \frac{dy}{dx} + y \sin x = \sec^2 x$
Q.2	Solve $(1 + x^3) \frac{dy}{dx} + 6x^2 y = e^x$
Q.3	Solve $\frac{dy}{dx} = 4y + 2x - 4x^2$
Q.4	Solve $\frac{dx}{dy} + \frac{1}{y+1} x = \frac{(y+2)}{y+1} e^y$
Q.5	Solve $(1 + y^2) \frac{dx}{dy} + (1 + y^2) \frac{1}{y} x = \frac{-1}{y}$
Q.6	Solve $\frac{dx}{dy} + x = e^{-y} \sec^2 y$
Q.7	Solve $x^2 y - x^3 \frac{dy}{dx} = y^4 \cos x$
Q.8	Solve $x \frac{dy}{dx} + y = y^2 \log x$



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Tutorial-III

Applications of Ordinary Differential Equations of First Order and First Degree-I

Course Outcomes (COs): After successfully completion of this tutorial, the students will be able to:	
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111.2	Apply the knowledge of ordinary differential equation of first order and first degree.
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Q.1	Find orthogonal trajectories of the family of curves $y = x + ce^{-x}$ where c is parameter
Q.2	Find orthogonal trajectories of the family of curves $y = (x - a)^2$ where a is parameter
Q.3	Find orthogonal trajectories of the family of curves $x = ky^3$ where k is parameter
Q.4	Find orthogonal trajectories of the family of curves $x^2 - y^2 = a$ where a is parameter
Q.5	The differential equation of a circuit containing a resistance R and a condenser of capacity C in series with e. m. f. E is $E = Ri + \int \frac{i}{C} dt$. Find the current i at any time t , when $E = E_0 \sin \omega t$.
Q.6	In a circuit of resistance R , self-inductance L , the current i is given by $L \frac{di}{dt} + Ri = E \cos pt$ where E, p are constant. Find the current i at time t .
Q.7	A current is flowing in a circuit of resistance $R=20$ ohms, self-inductance $L=0.05$ henry . If the current of 30 amp flows at the beginning , find its value after 0.01 second, there being no external e.m.f.
Q.8	A 30 volts electromotive force is applied to an LR circuit in which the inductance is 0.1 henry and resistance is 50 ohms. Find the current $i(t)$ at any time t if $i(0) = 0$. Also determine the current as $t \rightarrow \infty$.



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Tutorial-IV

Applications of Ordinary Differential Equations of First Order and First Degree-II

Course Outcomes (COs): After successfully completion of this tutorial, the students will be able to:	
111.2	Apply the knowledge of ordinary differential equation of first order and first degree.
Q.1	A body at a temperature of 40°C is kept in a surrounding of constant temperature of 20°C . It is observed that its temperature falls to 35°C in 10 minutes. Find how much more time will it take for the body to attain a temperature of 30°C ?
Q.2	A body at 200°F is placed in a room of 70°F . One minute later the body has cooled to 180°F . What will be the temperature of the body after 5 minutes?
Q.3	A body with a temperature of 100°C is immersed in a liquid that is kept constant temperature of 20°C . After 15 minutes, the temperature of the body decreased to 60°C . (a) Find the time it will take for the temperature of the body to decrease to 40°C (b) What will be the temperature of the body after 40 minutes?
Q.4	The population of a town increasing at a rate proportional to the population at that time. If the population increases from 40 thousand to 60 thousand in 40 years, what will be the population in another 20 years?
Q.5	In a certain culture of bacteria, the rate of increase is proportional to the number present. If it is found that the original number of bacteria doubles in 4 hours, find the number of times the bacteria are increased in 12 hours.
Q.6	In a certain culture of bacteria, the rate of increase is proportional to the number present. At time $t=0$ it has 10 bacteria in it, and at time $t=4$ it has 2000. At what time will it have 100000 bacteria?