Gautam Buddha University
Engineering Mathematics-III (MA-201)
Second semester (2016-2017)
Tutorial Sheet-1

Formulation of differential equation, Types of differential equations, Order and degree of differential equation, Method of Separable variables.

Question.1 Check whether the following differential equations are linear/non-linear, homogeneous/non-homogeneous. Also determine the order and degree (if possible) the differential equations.

(a) $[1+(\frac{dy}{dx})^2]^{1/2} = 5y$,

(b) $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + 6y = \log x$,

(c) $\frac{d^2y}{dx2} + 2(\frac{dy}{dx})^2 + y = x$,

(d) $(\frac{d^3y}{dx^3})^2 + 3(\frac{dy}{dx}) + 4y = 0$

(e) $\left[1+(\frac{dy}{dx})^2\right]^{1/2} = \frac{d^2y}{dx^2}$,

(f) $x^3\frac{d^3y}{dx^3} + x^2(\frac{d^2y}{dx^2})^2 + y^4 = 0$,

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

Question.2 Obtain various differential equations whose general solutions are given by:

1. $y^2 = 4a(x+a)$,
2. $y = a\cos(x+3)$,
3. $xy = Ae^x + Be^{-x} + x^2$,
4. $x^2 + y^2 = a^2$.
5. $y = 2cx - c^2$,
6. $y = c\sin x$,
7. $y = ae^{-x} + be^{-2x} + ce^{-3x}$.

Question.3 Define homogeneous differential equation. Show that

(a) it can be transformed to a separable variable form and hence always solvable.

(a) a straight line through origin intersects all integral curves of a homogeneous differential equation at the same angle.

Question.4 Verify that the given function satisfies the differential equation

(a) $y = ce^{-x^2}, \quad y' + 2xy = 0$ (b) $y = x\log x - x, \quad y' = logx$,

(b) $y = \sin^{-1} x, \quad y'' = \frac{x}{(1-x^2)^{3/2}}$ (b) $y = \sec x + \tan x, \quad (1-\sin x)^2 y'' = \cos x$.

Question.5 Define all types of solutions.

Q.6 Solve the following differential equations by variables separable method:

(a) $(1+x^2)dy - (1+y^2)dx = 0$

(b) $(1-x^2)(1-y)dx = xy(1+y)dy$

(c) $x^2(1+y)dx + y^2(x-1)dy = 0$

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

(e) $\frac{dy}{dx} = e^{x-y} + x^2e^{-y}$

(f) $\frac{dy}{dx} = (x+y)^2$