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BIOMEDICAL ENGINEERING

17/ENG08/004

ENG 381 ASSIGNMENT II

ENGINEERING MATHEMATICS III

Question 1.

$$y = e^{x^2+x}$$

Let $u = x^2 + x$. $\quad \frac{du}{dx} = 2x + 1$

$$y = e^u \qquad \frac{dy}{du} = e^u$$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx} = e^u(2x+1)$$

$$(2x+1)e^{x^2+x}$$

$$\frac{d^2y}{dx^2} = \quad u = (2x+1) \qquad \frac{du}{dx} = 2$$

$$v = e^{x^2+x} \qquad \frac{dv}{dx} = (2x+1)e^{x^2+x}$$

$$(2x+1)(2x+1)e^{x^2+x} + 2e^{x^2+x}$$

$d^2y/dx^2 = y'(2x+1) + 2y$

$y'' = y'(2x+1) + 2y$

$A = B + C.$

$A = y''$ $\quad A^n = y^{2+n}.$

$B = y'(2x+1)$

$U = y'$ $\quad y^n = y^{1+n}.$

$V = 2x+1$ $\quad V' = 2.$

$B^n = y^{1+n}(2x+1) + 2ny^n + 0.$

$C = 2y$

$U = 2y = 2y^n$

$\therefore y^{2+n} = y^{1+n}(2x+1) + 2ny^n + 2y^n$

$y^{2+n} = (2x+1)y^{1+n} + 2y^n(n+1)$

Question 2.

i $y = x^3 e^{4x}.$

$U = e^{4x}$; $U' = 4e^{4x}$; $U'' = 16e^{4x}$, $U''' = 64e^{4x}$

$U^{iv} = 256e^{4x}$; $U^5 = 1024e^{4x}.$

$V = x^3$; $V' = 3x^2$; $V'' = 6x$; $V''' = 6$; $V^{iv} = 0$; $V^5 = 0$

Using Leibnitz theorem

$y^n = U^nV + nU^{n-1}V' + \frac{n(n-1)}{2!}U^{n-2}V'' + \frac{n(n-1)(n-2)}{3!}U^{n-3}V''' + \dots$

$y^5 = 1024e^{4x}x^3 + 5(256e^{4x})(3x^2) + \frac{5(5-1)}{2!}64e^{4x}(6x) +$

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$$\frac{5(5-1)(5-2)}{3} 16e^{4x}(6) + \frac{5(5-1)(5-2)(5-3)}{4!} 4e^{4x}(6) + 0$$

$$= 1024x^3e^{4x} + 3840x^2e^{4x} + \frac{20}{\cancel{2!}} 384xe^{4x} + \frac{60}{3!} 96e^{4x}$$

$$+ 0.$$

$$y^5 = 1024x^3e^{4x} + 3840x^2e^{4x} + 3840xe^{4x} + 960e^{4x} + 0$$

$$y^5 = 4e^{4x}(256x^3 + 960x^2 + 960x + 240)$$

$$4e^{4x}.16(16x^3 + 60x^2 + 60x + 15)$$

$$y^5 = 64e^{4x}(16x^3 + 60x^2 + 60x + 15).$$

ii $$x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0.$$

$$x^2y'' + xy' + y$$

$$A + B + C = 0.$$

$$A = x^2y''$$

$$U = y^{2+n} \quad U^n = y^{2+n}.$$

$$V = x^2 \quad V' = 2x;\ V'' = 2.$$

$$A^n = y^{2+n}x^2 + n\,2xy^{1+n} + \frac{n(n-1)}{\cancel{2}} \cancel{2}y^n + 0$$

$$A^n = x^2y^{2+n} + 2nxy^{1+n} + (n^2 - n)y^n + 0$$

$$B = xy'$$

$$U = y' \quad ; \quad U^n = y^{1+n}$$

$$v = x \quad v' = 1 \quad v'' = 0$$

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$$B^n = y^{1+n} x + n y^n + 0.$$

$$C = y \quad ; \quad C^n = y^n$$

$$\therefore \quad x^2 y^{2+n} + 2n x y^{1+n} + (n^2 - n) y^n + y^{1+n} x + n y^n + y^n = 0.$$

$$\therefore \quad x^2 y^{(n+2)} + y^{1+n} x (2n+1) + y^n (n^2 \cancel{- n + n} + 1) = 0$$

$$x^2 y^{(n+2)} + (2n+1) x y^{(n+1)} + (n^2+1) y^n = 0$$

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