

**BACHELOR OF CIVIL ENGINEERING (EVENING) EXAMINATION, 2018  
(1st Year, 1st Semester, Old Syllabus)**

**Mathematics - I**

Time : Three hours

Full Marks : 100

Answer any **six** questions.

Four marks are reserved for neatness.

(Notations have their usual meanings)

1. Solve the following differential equations : 4x4

(a)  $\frac{dy}{dx} = (4x + y + 1)^2$

(b)  $\frac{dy}{dx} - x \tan(y - x) = 1$

(c)  $ydx - xdy = \sqrt{x^2 + y^2} dx$

(d)  $(x^2 - y^2)dx - xydy = 0$

2. Solve the following differential equations : 4x4

(a)  $\frac{dy}{dx} = \frac{x^2 - ay}{ax - y^2}$

(b)  $y \sin^2 x dx - (1 + y^2 + \cos^2 x) dy$

(c)  $ye^{xy} dx + (xe^{xy} + 2y) dy = 0$

(d)  $(\sec x \tan x \tan y - e^x) dx + \sec x \sec^2 y dy = 0$

(Turn over)

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3. Solve the following differential equations : 4x4

(a)  $4xydx + (x^2+1) = 0$

(b)  $\left( x \tan \frac{y}{x} + y \right) dx - xdy = 0$

(c)  $\left( y + \sqrt{x^2 + y^2} \right) dx - xdy = 0$

(d)  $(x^2 - 3y^2)dx + 2xydy = 0$

4. Solve the following differential equations : 8+8

(a)  $(D^2 - 5D + 6)y(x) = x^3e^{2x}$

(b)  $(x^2D^2 - xD - 3)y(x) = x^2 \log x$

5. (a) Prove that

$$\text{Cos}x = J_0(x) - 2J_2(x) + 2J_4(x) \dots$$

$$\text{and Sin}x = 2J_1(x) - 2J_3(x) + 2J_5(x) \dots$$

(b) Prove that

$$J_{\frac{5}{2}}(x) = \sqrt{\frac{2}{\pi x}} \left( \frac{3-x^2}{x^2} \sin x - \frac{3}{x} \text{Cos}x \right)$$

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6. Solve : 5+5+6

(a)  $L [\text{Sin}5t \text{ Cos}3t]$

(b)  $L^{-1} \left[ \frac{1}{s(x^2 + 9)} \right]$

(c)  $y''(t) - 2y'(t) - 8y(t) = 0$  subject to the initial conditions  $y(0) = 3$  and  $y'(0) = 6$ .

7. Evaluate : 4x4

(a)  $L [\sin 2t \cos 3t]$

(b)  $L^{-1} \left[ \frac{s}{(s^2 + 1)(s+1)^2} \right]$

(c)  $L^{-1} \left[ \frac{s+8}{(s^2 + 4s + 5)} \right]$

(d)  $L [e^{3t} \cos 5t \sin 3t]$

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