Code No. 14002

FACULTY OF ENGINEERING

B.E. I-Year (Backlog) Examination, March/April 2021

Subject : Mathematics - II

Time: 2 hours **Max. Marks: 75**

Note: Missing Data, if any, may be suitably be assumed.

PART – A

Answer any seven questions. **(7x3=21 Marks)**

1 *Find integrating factor of the differential equation* $(x^2y - 2xy^2)\,dx - (x^3 - 3x^2y)\,dy = 0$.

2 Find the orthogonal trajectories of family of curves $r^2 = a^2 \cos 2\theta$.

3 Solve $(D^2 + 1)y = 0$.

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

5 Define regular point and irregular singular point of the differential equation.

6 Show that $P_n'(1) = \frac{n(n+1)}{2}$.

7 Define Complementary error function. Show that $\text{erfc}(x) + \text{erfc}(-x) = 2$.

8 Write the properties of Bessel functions.

9 Find L(t sin 3t).

10 Find $L^{-1}\frac{(s^2 - 3s + 4)}{s^3}$.

PART – B

Answer any three questions. **(3x18 = 54 Marks)**

11 (a) Solve $\frac{dy}{dx} = \frac{x^2 + y^2 + 1}{2xy}$.

(b) A body originally at 80°C cools down to 60°C is 20 minutes, the temperature of the air being 40°C. What will be the temperature of the body after 40 minutes from the original.

12 (a) Solve by method of variation of parameters:

$$\frac{d^2y}{dx^2} + y = \tan x$$

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

13 (a) Solve in series of the equation $\frac{d^2y}{dx^2} + x^2y = 0$.

(b) Show that $nP_n(x) = xP_n'(x) - P_{n-1}'(x)$.

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14 (a) Show that $\int_0^\infty e^{-x^2}dx = \frac{\sqrt{\pi}}{2}$.

(b) Prove that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ where $m, n > 0$.

15 (a) Find $L\left(\int_0^\infty e^{-t}\cos t\, dt\right)$.

(b) Using convolution theorem, evaluate $L^{-1}\left(\frac{1}{(s^2+1)(s^2+9)}\right)$.

16 (a) Solve $x^2(y - px) = yp^2$.

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

17 (a) Show that $\int_{-1}^{1} xP_n(x)P_{n-1}(x)dx = \frac{2n}{4n^2-1}$.

(b) Using Laplace Transform, solve the equation $(D^2+n^2)x = a\sin(nt+\alpha), x = Dx = 0$ at $t = 0$

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