Seat No	

F.Y.B.Tech. (Part-I) (Semester - II) (CBCS)
Examination, June– 2025
ENGINEERING MATHEMATICS- II
Sub. Code : 72500

Day and Date : Tuesday, 03/06/2025 **Total Marks :70**

Time : 10.30 a.m. to 1.00 p.m.

Instructions : **1) 1) Attempt any three questions from each section.**
2) Figures to the right indicate full marks.
3) Use of non-programmable calculator is allowed.

SECTION-I

Q. 1) a) Solve $\left(y^2e^{xy^2}+4x^3\right)dx+\left(2xye^{xy^2}+\sec^2\ y\right)dy=0.$ **(6)**

b) Solve $(x^2+2x+y^2)dx+2ydy=0.$ (6)

Q. 2) a) Find the orthogonal trajectory of $\frac{x^2}{a^2}+\frac{y^2}{b^2+\lambda}=1$, where λ is parameter. **(5)**

b) In a circuit containing resistance R, inductance L and a constant e.m.f. E, the current i is given by $\mathrm{L}\frac{di}{dt}+Ri=E$. If $\mathrm{L}=640$ h, $\mathrm{R}=250\Omega$, $\mathrm{E}=500$ V and $i=0$ when $t=0$, find the time that elapses before the current reaches to 90% of its maximum value. **(6)**

Q. 3) a) Use Taylor's series method to solve $\frac{dy}{dx}=3x+y^2$, with $y(0)=1$ at $x=0.1$. **(5)**

b) Use Euler's modified method to solve $\frac{dy}{dx}=x^2+y$, with $y(0)=1$ at $x=0.1$, taking $\mathrm{h}=0.05$. **(6)**

Q. 4) Attempt any two of the following.

a) Solve sec $y\frac{dy}{dx} + \frac{\sin y}{x} = e^x \cos y$. **(6)**

b) A body heated to 80˚C cools to 50˚C in 5 minutes. If the temperature of the surroundings is 20˚C, find the temperature after 10 minutes. **(6)**

c) Apply Runge-Kutta's method of fourth order to solve $\frac{dy}{dx} = \frac{y+x}{xy}$, with y (1) = 1 at $x = 1.1$. **(6)**

SECTION-II

Q.5) a) Perform five iterations of the bisection method to obtain the smallest positive root of the equation $x^3 - 5x + 1 = 0$. **(6)**

b) Find the positive root of the equation $xe^x = \cos x$ correct to three decimal places using Secant method. **(6)**

Q.6) a) Evaluate $\int_0^\infty \frac{x^7}{7^x} dx$. **(6)**

b) Evaluate $\int_0^2 x^4(8 - x^3)^{-\frac{1}{3}} dx$. **(5)**

Q.7) a) Evaluate $\int_0^1 \int_{y^2}^{y} (1 + xy^2) dx dy$. **(5)**

b) Change the order of integration and evaluate. **(6)**

$$\int_0^1 \int_0^{\sqrt{1-x^2}} \frac{e^y}{(e^y+1)\sqrt{1-x^2-y^2}} dy dx.$$

Q.8) Attempt any TWO of the following.

a) Using Newton-Raphson method, find the real root of the equation $3x - \cos x - 1 = 0$, correct to four decimal places. **(6)**

b) Express erf(x) as an infinite series and find erf(0.3). **(6)**

c) A lamina is bounded by $y = x^2 - 3x$ and $y = 2x$. If the density of any point is given $\frac{24}{25}xy$, find the mass of the lamina. **(6)**