

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-III (OLD) EXAMINATION – WINTER 2024****Subject Code:130001****Date:18-12-2024****Subject Name: Mathematics-III****Time:10:30 AM TO 01:30 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q-1** (a) (i) Solve $5yy' + 7x = 0$ **03**
(ii) Solve $(x^2 - 4xy - 2y^2)dx + (y^2 - 4xy - 2x^2)dy = 0$ **04**
(b) Find series solution for $y' - 2xy = 0$ **07**

- Q-2** (a) (i) Solve $2y'' + 3y' + y = 0$ **03**
(ii) Solve $3y'' + 4y' + 2y = e^{2x}$ **04**
(b) Solve $(1 + x^2)\frac{dy}{dx} + 2xy = \cos x$ **07**

OR

- (b) Solve the IVP $y'' + y' - 2y = 0, y(0) = 4$ and $y'(0) = -5$ **07**

- Q-3** (a) (i) Find $L(t \sin at)$ **03**
(ii) Find $L^{-1}\left(\frac{6s-7}{s^2+5}\right)$ **04**
(b) Solve $y'' + 4y = \sec 2x$ using method of variation of parameters. **07**

OR

- Q-3** (a) (i) Find $L\left(\frac{1-\cos 2t}{t}\right)$ **03**
(ii) Find $L^{-1}\left(-\frac{s+10}{s^2-s-2}\right)$ **04**
(b) Solve $y'' + 4y = 8x^2$ using method of undetermined coefficients. **07**

- Q-4 (a) (i)** Evaluate $B\left(\frac{9}{2}, \frac{7}{2}\right)$ **03**
04
- (ii)** Find a Fourier sine series for $f(x) = \pi x - x^2; 0 < x < \pi$
- (b)** Obtain Fourier series to represent $f(x) = x^2$ in the interval $0 \leq x \leq 2\pi$ **07**
- OR**
- Q-4 (a) (i)** Prove that $B(m, n) = B(m+1, n) + B(m, n+1)$ **03**
04
- (ii)** Find a Fourier cosine series for $f(x) = e^x; 0 < x < \pi$
- (b)** Obtain Fourier series to represent $f(x) = \pi - x$ in the interval $0 < x < 2\pi$ **07**
- Q-5 (a) (i)** Solve $xp^2 - yp + a = 0$ **03**
04
- (ii)** Solve $yp - xq = 0$
- (b)** Solve the IVP using the Laplace Transform **07**
 $y'' + 4y = 0, y(0) = 1, y'(0) = 6.$
- OR**
- Q-5 (a) (i)** Solve $p = \log(px - y)$ **03**
04
- (ii)** Prove that $J_0'(x) = -J_1(x)$
- (b)** Solve the IVP using the Laplace Transform **07**
 $y'' + 6y = 1, y(0) = 2, y'(0) = 0.$
