

Roll No.

3026

**B. Tech. 3rd Semester (Civil Engg.)
Examination – March, 2021**

MATHEMATICS - III

Paper : BSC-MATH-205-G

Time : Three Hours]

[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) Solve $p + q = pq$.
- (b) Solve $yp - 2yx = \log q$.
- (c) Explain working rule of trapezoidal to solve $\int_a^b f(x)dx$.
- (d) Find Laplace transform of $e^{-2t} \sin^2 3t$.
- (e) Find $L^{-1} \left(\frac{3(s^2 - 1)^2}{2s^5} \right) = ?$

- (f) If (G, \bullet) is group, then show that left inverse of an element is also its right inverse.

UNIT - I

- (a) Solve $p^2y - qz = -q^2y$ by using Charpit's method.
(b) Solve $(y^2 + z^2)p - 2xyq = x^2p - 2xz.$
- (a) Solve $(x^2 - yz)p + xy = (zx - y^2)q + z^2.$
(b) A rod of length l with insulated sides is initially at a uniform temperature u_0 . Its ends are suddenly cooled to 0°C and are kept at that temperature. Find the temperature function $u(x, t)$.

UNIT - II

- Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ using Trapezoidal rule and Simpson's $\frac{1}{3}$ rule taking $h = 0.25$.
- Use Regula Falsi method to compute the real root of the equation $x^3 - 9x + 1 = 0$.

UNIT - III

- State and prove Convolution theorem and verify it for $\frac{1}{(s^2 + 1)(s^2 + 4)}$.

- (a) Find $L^{-1} \left\{ \frac{us + 5}{(s-1)^2(s+2)} \right\} = ?$
(b) Solve $y'' + 4y' + 7y = e^{-t}$, $y(0) = y'(0) = 1$, by using Laplace Transforms.

UNIT - IV

- (a) (i) How many solutions are there of $x + y + z = 17$, subject to the constraints $x \geq 1, y \geq 2$ and $z \geq 3$.
(ii) Show that if any five integers from 1 to 8 are chosen, then at least two of them will have sum 9.
(b) State and prove Lagrange's Theorem.
- (a) Prove a non-empty subset H of a group G is a subgroup of G if and only if:
(i) $a \in H, b \in H \Rightarrow a.b \in H$
(ii) $a \in H \Rightarrow a^{-1} \in H$
(b) If (G, \bullet) is cyclic group generated by 'a' of order n , then a^m is a generator of G iff the g.c.d. of m and n is 1.