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M. Sc. (Sem. - IV) Examination October - 2025

Mathematics (Paper - PGMTH 406) Skill based Elective Paper - Curve Theory

Time: 2 Hours] **[Total Marks: 30**

સૂચના : / Instructions

(1) ઉપરોક્ત દર્શાવેલ વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fill up strictly the above details on your answer book.
(2) Attempt ANY SIX out of the following Nine questions.
(3) Each question carries 5 marks.
(4) Follow usual notations.

Seat No.:

Student's Signature

Q. 1. Find the length of one complete turn of the circular helix,
$r(u) = a\cos u\,\hat{i} + a\sin u\,\hat{j} + cu\,\hat{k}$; where $-\infty < u < \infty$.

Q. 2. Prove that for any curve $[b', b'', b'''] = \tau^3[K'\tau - \tau' K] = \tau^5 \frac{d}{ds}\left(\frac{K}{\tau}\right)$.

Q. 3. Find the plane that has three-point contact at the origin with the curve
$x = u^4 - 1, y = u^3 - 1$ & $z = u^2 - 1$.

Q. 4. Find the Radius of curvature and torsion of the helix,
$x = a\cos u$, $y = a\sin u$ and $z = au\tan\alpha$.

Q. 5. Define Osculating Circle. Find the radius and centre of osculating circle.

Q. 6. Prove that the necessary and sufficient condition for a curve to be a helix is that ratio of curvature and torsion is constant.

Q. 7. Show that necessary and sufficient condition that a curve lies on a sphere is that,
$\frac{\rho}{\sigma} + \frac{d}{ds}\left(\frac{\rho'}{\tau}\right) = 0$ at every point on a curve.

Q. 8. Define Bertrand Curves. For Bertrand curves show that the tangents at the corresponding points of the two curves makes a constant angle.

Q. 9. Prove that the curve given by $x = a\sin u$, $y = 0$, $z = a\cos u$ lies on a sphere.