15.12.17

M.Sc. Integrated(Generic)-I (First Semester)
End-Semester Examination December 2017
Department of Mathematics, SOPS, Doon University Dehradun
Course: MAG-103, Applied Calculus

Time Allowed: 3 Hours **Maximum Marks: 100**

*Note: 1. Attempt All Questions from **Sections A & B.***
*2. Attempt **any four** questions from **Section C.***
***3. Length** of each **answer** should be according to the **marks** allotted.*

Section A

Q.1. Answer very briefly: (2 marks each)

(i) State Cauchy's Mean Value Theorem.

(ii) Write the relation between Cartesian coordinates with cylindrical and spherical coordinates of any point in three dimensional space.

(iii) Find for the funtion so on.

(iv) Define maxima and minima.

(v) Write the formula for arc length 'L' of a curve whose equations in parametric form are given by

(vi) What type of surface is formed when the line-segment , is revolved around x-axis? Also, write down its dimensions and roughly sketch the graph.

(vii) Define a vector-valued function and its derivative. Give an example.

(viii) Define Gradient, Divergence and Curl of a vector.

(ix) Write Frenet-Seret Formulas for **T**, **N** and **B** of a space curvewhere the symbols have usual meanings. Also, draw diagram.

(x) Define 'Osculating plane' and 'intrinsic equations' of a curve.

Section B (8 marks each)

Q.1. (i) Find the local minimum and maximum value of the function

(ii) Evaluate using L'Hospitals's rule.

Q.2. (i) Determine all the numbers ‘’ which satisfy the conclusions of the Lagrange’s Mean Value Theorem for the function on the interval .

(ii) Find the asymptotes of the curve .

Q.3 (i) Determine the volume of the solid obtained by rotating the region bounded by the x-axis and the curve about y-axis.

(ii) Determine the volume of sphere of radius, using slicing/disc method.

Q.4. (i) State and prove Kepler’s second law for planetary motion.

(ii) Find the tangential and normal components of acceleration of a particle with position vector , at , without finding **T** and **N**.

Q.5. (i) A particle is projected from point ‘O’ with velocity in a direction making an angle with the horizontal. At any instant its velocity vector at point P is at right angles to the initial direction of projection. Find its velocity in terms of and . Draw diagram.

(ii) Find the tangent plane and normal line to the curve at the point

Section C

(10 marks each)

Q.1. (i) Find the radius of curvature of the curve .

(ii) For the curve show that the radius of curvature is directly proportional to .

Q.2. (i) Find the Taylor’s series of the function about the point .

(ii) Find the points of inflexion of the curve

Q.3. (i) Determine the volume of the solid obtained by rotating the region bounded by and about the line , using Washer’s method. Sketch the region also.

(ii) Find the volume of the parallelepiped whose edges are determined by the vectors and .

Q.4. (i) Trace the curve .

(ii) Find the arc-length of the curve from to .

Q.5. (i) Prove that the dot product of a function of constant magnitude with its derivative is zero.

(ii) Write the parametric equations of sphere and paraboloid with parameters and .

(iii) Derive the intrinsic equations of circular helix.