Semester 1

Core Paper 1: **Foundation in Calculus and Geometry**

Paper Code: HMTCR1011TFull Marks: 100 (78 Classes) Total Credit:6=5+1(Th+Tutorial)

Course objective: *Familiarize students with practical application of calculus. Enables students to handle geometrical entities like straight lines, planes, spheres. It helps students to formulate mathematical models of real life situations involving one independent variable.*

Module-I: Calculus-I (39 Classes)

Unit-1: Application of Calculus-I (15)

Higher order derivatives and Leibnitz rule.**(2)** Indeterminate form: L'Hospital's rule **(2)**. Tangent and Normal: Cartesian, Polar and Pedal Equation of familiar curves **(5)**. Curvature **(2)**. Asymptotes (Cartesian equation only)**(2)** , concavity and inflection points **(2)**.

Unit-2: Differential Equation (24)

Ordinary differential equations and its formulations[2]. General , particular, explicit, implicit and singular solutions of a differential equation[1]. Exact differential equations of first order[2]. Non exact differential equations of first order and integrating factors, linear equation and Bernoulli equations, special integrating factors and transformations.[5]

Introduction to compartmental model, exponential decay model, lake pollution model (case study of Lake Burley Griffin), drug assimilation into the blood, exponential growth of population, limited growth of population, logistic model of growth for population. [8]

First order ode of higher degree: equations solvable for x, y and p. Clairaut's equations and differential equations transformable into Clairaut's form. Singular solutions. [6]

Module-II: Calculus and Geometry (39 Classes)

Unit-1: Application of Calculus-II (15)

Reduction formulae: Illustrations of reduction formulae of the type $\int\sin^n x\, dx$, $\int\cos^n x\, dx$, $\int\tan^n x\, dx$, $\int\sec^n x\, dx$, $\int(\log x)^n\, dx$, $\int\sin^n x \sin^m x\, dx$. **(5)** Arc length of a curve **(3)**, area under a curve **(3)**, area and volume of surface of revolution (no derivation of formula required) **(4)**

Unit-2: Coordinate Geometry (24)

  Two dimensional Geometry: General equation of second degree in two variables and reduction to canonical form by Method of Invariants **(6)**,Polar equation of conics **(3)**
  Three dimensional Geometry: Straight lines and Planes **(7)**.Sphere **(2)**. Cone, Cylinder**:** generating lines **(6)**

<u>**References:**</u>

(1) R. Kent Nagle, Edward B. Saff, Arthur David Snider --Fundamentals of Differential Equations (8 th Ed.),Pearson
(2) Differential Equations – D.A.Murray [Orient Longmann]
(3) S.L. Ross: Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
(4) S.L Loney: The elements of coordinate geometry.

(5) Shanti Narayan: Integral Calculus

(6) Shanti Narayan: Differential Calculus

Graphical Demonstration (Teaching Aid)

1. Plotting of graphs of function e^{ax+b}, log(ax + b), 1/(ax + b), sin(ax + b), cos(ax + b), |ax + b| and to illustrate the effect of a and b on the graph.

2. Sketching curves: Cartesian, Polar, Parametric equations.

3. Problem Solving