I YEAR M. TECH (MACHINE DESIGN) FIRST SEMESTER

17MEMD1T4 GEOMETRIC MODELING Credits 4

Lecture: 4 periods/week **Internal assessment: 40 marks**

Tutorial: - - **Semester end examination: 60 marks**

COURSE OBJECTIVES:

Make the student enable to

- Various representation schemes used for geometric entities used in geometric modeling, and various entity manipulation techniques.
- Algebraic, geometric form of cubic, Bezier, and B-spline curves and their properties, derivatives.
- Parametric representation of analytic and synthetic surfaces
- Basic solid model representation schemes, algebraic, geometric form of a tri-cubic solid.

COURSE OUTCOMES:

At the end of this course the students will be able to

1. Express types of manipulation techniques, mathematical representation schemes for various entities used in geometric modeling.
2. Formulate algebraic and geometric form of a cubic spline, Bezier, and B-Spline curves and their derivatives.
3. Develop parametric representation of analytic and synthetic surfaces.
4. Distinguish various schemes used for construction of solid models and express a tri-cubic solid algebraically and geometrically.

UNIT-I

Transformations– 2D & 3D Transformations- Scaling, Rotation, Shearing, Zooming, Viewing Transformations, Reflection, rotation about an axis, concatenation.

CUBIC SPLINES-

Definition, Explicit and implicit equations, parametric equations. Algebraic and geometric form of cubic spline, tangent vectors, parametric space of a curve, blending functions, four point form, reparametrization, truncating and subdividing of curves.

UNIT-II

BEZIER CURVES: Bezier curve definition, matrix representation of Bezier curves, Bernstein basis, equations of Bezier curves, properties, derivatives, increasing the flexibility of Bezier curves, degree elevation.

B-SPLINE CURVES: B-Spline curve definition, properties, convex hull properties of B-spline, knot vectors, B-spline basis function, B-spline curve control, open, periodic, non uniform B-spline curves, matrix formulation of B-spline curve, end conditions of periodic B-spline curve, equations, and derivatives.

UNIT-III

INTRODUCTION: Surface Models, Surface Representation. Parametric Representation of Analytic Surfaces - Plane Surface, Ruled Surface, Surface of Revolution, Tabulated Cylinder. Parametric Representation of Synthetic Surfaces - Hermit Bi-cubic Surface, Bezier Surface, B-Spline Surface, Coons Surface, Gaussian curvature.

UNIT-VII

SOLID MODELING CONCEPTS: Boundary representation, half space modeling, spatial cell, cell decomposition.

SOLIDS: Tri-cubic solid, Algebraic and geometric form.

Learning Resources

Text Books:

1. Geometric Modeling (1st edition) by Micheal. E. Mortenson, McGraw Hill Publishers First edition
2. Elements of Computer Graphics (1st edition) by Roger & Adams Tata McGraw Hill. First edition

Reference:

1. An Introduction to Nurbs with Historical perspective (1st edition) by David F Rogers. First edition