**INDIAN INSTITUTE OF INFORMATION TECHNOLOGY**
**DESIGN AND MANUFACTURING (IIITD&M) KANCHEEPURAM**

INTRODUCTION OF NEW COURSE

<table>
<tr><td>Course Title</td><td>Advanced Geometric Modelling and CAD</td><td>Course No<br>(will be assigned)</td><td colspan="4"></td></tr>
<tr><td>Specialization</td><td>Mechanical Engineering</td><td>Structure (LTPC)</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Offered for</td><td>PG/Ph.D.</td><td>Status</td><td colspan="2">Core ☐</td><td colspan="2">Elective ■</td></tr>
<tr><td>Faculty</td><td>Dr P Pandithevan</td><td>Type</td><td colspan="2">New ■</td><td colspan="2">Modification ☐</td></tr>
<tr><td>Pre-requisite</td><td>Engineering mathematics</td><td>To take effect from</td><td colspan="4">Jan 2013</td></tr>
<tr><td>Submission date</td><td>Sep 2012</td><td>Date of approval by AAC</td><td colspan="4"></td></tr>
<tr><td>Objectives</td><td colspan="6">➢ To make the students to understand the mathematical basis for geometric modeling of curves and surfaces and their relationship with computer graphics.<br>➢ To teach advanced concepts of feature based modelling and parametric modelling.<br>➢ To teach the methods of representation of wireframe, surface, and solid modeling systems.<br>➢ The course also aims at considering the data associativity concepts of CAD/CAE and makes the students to be familiar with collaborative design tools including virtual prototyping.</td></tr>
<tr><td>Contents of the course (With approximate break up of hours)</td><td colspan="6">Computer graphics fundamentals: Introduction to geometric representation- Implicit, explicit, parametric equations; Transformations in 2D and 3D, projections (6)<br><br>Parametric curves: Differential geometry of curves, Cubic Hermite curves - Algebraic and geometric form, Blending functions, subdivision, reparameterization and composite Hermite curves, continuity aspects, Bezier curves - control polygons and Bernstein basis, de Casteljau algorithm, continuity aspects, rational Beziers, B-spline curves - periodic, open and non-uniform knot vectors and corresponding curves, rational B-splines, NURBS curve (10)<br><br>Parametric surfaces: Hermite surface - algebraic and geometric form, subdivision and reparameterization, continuity of surfaces, Bezier surface - control net representation, continuity aspects, rational Bezier surfaces, B-Spline surfaces - periodic, open and non-uniform knot vectors and corresponding surfaces, rational B-splines, NURBS surface (10)<br><br>Representation of solids: Topology of surfaces, Euler and modified form of equations, representations - Quadtree, Octree, Halfspace, Boundary Representation (B-Rep), Constructive Solid Geometry (CSG), Boolean operations in 2D - set membership classification, Union, Difference and Intersection (10)<br><br>Data exchange in CAD/CAM: File formats - Native and neutral formats for contour, surface and Solid, Error handling in CAD, Interfacing with manufacturing systems (6)</td></tr>
<tr><td>Textbook</td><td colspan="6">1. Zeid. I, CAD/CAM Theory and Practice, Tata McGraw Hill, 2006.<br>2. Rogers. D.F and Adams, J.A, Mathematical Elements for Computer Graphics, McGraw Hill, 2002.<br>3. M. E. Mortenson, Geometric Modeling, John Wiley & Sons, 1985.</td></tr>
<tr><td>References</td><td colspan="6">1. Gerald E. Farin, Curves and Surfaces for CAGD, Morgan Kaufmann, 2002.<br>2. Rogers. D.F, An Introduction to NURBS, Morgan Kaufmann, 2001.<br>3. M. E. Mortenson, Mathematics for Computer Graphics Applications, 2nd ed., Industrial Press, 1999.<br>4. Hoschek. J and Lasser. D, Computer Aided Geometric Design, AK Peters, 1996.</td></tr>
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