



Mathematics Paper-I
Computational Geometry
[CORE COURSE]

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| Semester: IV | Credits: 2 | Subject Code: BS42103 | Lectures: 36 |
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Course Outcomes:

After completion of the course, the learner will be able to

- Illustrate the basic structures of 2D and 3D graphics systems, construct and apply composite transformations.
- Explain the core concepts of computer graphics, including projection, perspective, and transformation in two and three dimensions.
- Identify the parallel and perspective projections.
- Develop the points on various curves.

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| Unit 1: Two-Dimensional Transformations | 12 |
| <ul style="list-style-type: none">• Introduction.• Representation of points.• Transformations and matrices.• Transformation of points.• Transformation of straight lines• Midpoint Transformation• Transformation of parallel lines• Transformation of intersecting lines• Transformation: rotations, reflections, scaling, shearing.• Combined transformations.• Transformation of a unit square.• Solid body transformations.• Translations and homogeneous coordinates.• Rotation about an arbitrary point.• Reflection through an arbitrary line. | |

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| Unit 2: Three-Dimensional Transformations | 8 |
| <ul style="list-style-type: none">• Introduction.• Three dimensional – Scaling, shearing, rotation, reflection, translation.• Multiple transformations.• Rotation about – an axis parallel to coordinate axes, an arbitrary line• Reflection through – coordinate planes, planes parallel to coordinate planes, an arbitrary plane | |

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| Unit 3: Projection | 8 |
| <ul style="list-style-type: none">• Orthographic projections.• Axonometric projections.• Oblique projections• Single point perspective projection | |

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| Unit 4: Plane and space Curves: | 8 |
| <ul style="list-style-type: none">• Introduction.• Curve representation.• Parametric curves.• Parametric representation of a circle and generation of points on circle.• Parametric representation of a circle and generation of points on ellipse.• Parametric representation of a circle and generation of points on parabola.• Bezier Curves – Introduction, definition, properties (without proof),• Curve fitting (up to $n = 3$), equation of the curve in matrix form (upto $n = 3$) | |

No of Teaching Hours 36 + Contact Hours: 12

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| Recommended Text Books: |
| <ul style="list-style-type: none">• D. F. Rogers, J. A. Adams, <i>Mathematical elements for Computer graphics</i>, Mc Graw Hill Intl Edition.<ul style="list-style-type: none">○ Unit 1: Chapter 2: Sec. 2-1 to 2.17○ Unit 2: Chapter 3: Sec. 3.1 to 3.10,○ Unit 3: Chapter 3: Sec. 3.12 to 3.14○ Unit 4: Chapter 4: Sec. 4.1, 4.2, 4.5, Chapter 5: Sec. 5.1, 5.8• Schaum Series, Computer Graphics.. |

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| Reference Books: |
| <ul style="list-style-type: none">• Donald Hearn, M. Pauline Baker, Warren Carithers, <i>Computer Graphics with OpenGL</i>, Pearson (4th Edition) |

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| Chairperson (HoD) | Gitanjali Phadnis | <i>G. M. Phadnis</i> 20/3/2021 |
| Faculty | Vrushali Paranjpe | <i>V. Paranjpe</i> 20/3/2021 |
| Subject Expert (Outside SPPU) | Dr. Machchhindra Gophane | <i>M. Gophane</i> 20/3/21 |
| Subject Expert (Outside SPPU) | Dr. Prashant Malavadkar | <i>P. Malavadkar</i> 20-03-2021 |
| VC Nominee | Dr. Vinayak Joshi | <i>V. Joshi</i> 20/3/21 |
| Industry Expert | Mr. Anup Manakeshwar | <i>A. Manakeshwar</i> 20-03-2021 |
| Alumni | Ms. Jyoti Sharma | <i>Jyoti</i> 20/03/2021 |

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