

Second Edition

TU, PU, PoU, KU

Insights on COMPUTER GRAPHICS



Written by:
Er. Shree Krishna Sulu

Edited by:
Er. Sujan Shrestha

Insights on

COMPUTER GRAPHICS

Written by

Er. Shree Krishna Sulu

(Associate Prof., Kathmandu Engineering College)

Edited by

Er. Sujan Shrestha

(Lecturer, Kathmandu Engineering College)

SYSTEM INCEPTION

Koteshwor, Kathmandu

Insights on COMPUTER GRAPHICS

Published by : **SYSTEM INCEPTION**

Written by : *Er. Shree Krishna Sulu*

Edited by : *Er. Sujan Shrestha*

Copyright © : Publisher

All rights reserved. This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, resold, hired out, or otherwise circulated without the authors' prior written consent in any form of binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser and without limiting the rights under copyright reserved above, no part of this publication may be reproduced, stored in or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise), without the prior written permission of the copyright owner of the book.

First edition : 2019 AD

Second edition : 2020 AD

Computer : Creation Graphics
Bagbazar, Kathmandu

PREFACE TO THE SECOND EDITION

"**Insights on Computer Graphics**" is a textbook of computer graphics for the students of Bachelor level in Electronics and Communication, and Computer Engineering. Computer graphics is widely used in almost all aspects of the life; entertainment to medical treatment, art and commerce to office automation, business visualization to scientific research, computer aided design to virtual reality. And, the daily use of smart mobile, tab, laptop, digital display, smart TV, etc. is tremendously increasing. So, the study and field of computer graphics is widening day by day. The concept and principle of computer graphics systems have been explained step by step in this book in order to make easier to understand.

A large number of numerical of previous IOE exam questions have been solved to develop an efficient understanding of the related topics. The Code in C of some algorithms is also depicted to make clear about the programming in Computer Graphics.

I would like to thank those teachers and students (especially Shyam Dahal and Shiva Ram Sulu) whose inspiration assisted me in bringing this book.

With the hope, students and concerned person will be benefitted, I pray for a prosperous and peaceful Nepal.

Er. Shree Krishna Sulu
Feb. 2020

CONTENTS

Chapter 1

INTRODUCTION AND APPLICATION

1.1	Introduction.....	1
1.2	Raster Graphics.....	2
1.3	Vector Graphics	3
1.4	Computer Graphics and Image Processing	5
1.5	History of Computer Graphics	5
1.6	Uses of Computer Graphics	8
1.7	General Term and Terminologies	12
1.8	Hardware Concepts.....	16
1.9	Refresh Cathode Ray Tube	21
1.10	Raster and Random (Vector) Scan Display.....	23
1.11	Color CRT Monitors	26
1.12	Raster Scan Display System/ Architecture/ Technology.....	29
1.13	Random Scan System/Architecture/Technology.....	32
1.14	Flat Panel Displays.....	33

Chapter 2

SCAN CONVERSION

2.1	Output Primitives	38
2.2	Line-Drawing Algorithm	38
2.3	Circle.....	54
2.4	Ellipse	58
2.5	Filled Area Primitive.....	65

Chapter 3

TWO-DIMENSIONAL TRANSFORMATIONS

3.1	Introduction.....	79
3.2	Basic Transformations	79
3.3	Homogeneous Co-ordinates and Matrix Representations	83
3.4	Composite Transformation.....	87
3.5	Other Transformations	88

3.6	Two-Dimensional Viewing.....	94
3.7	Coordinate Representation.....	94
3.8	The Viewing Pipeline.....	95
3.9	Window to Viewport Mapping (Coordinate Transformation)	98
3.10	Clipping Operations.....	102

Chapter 4

THREE-DIMENSIONAL TRANSFORMATIONS

4.1	Three-Dimensional Transformations	125
-----	---	-----

Chapter 5

CURVE MODELING

5.1	Spline Representations.....	161
5.2	Hermite Cubic Spline.....	168
5.3	Bezier Curves.....	172
5.4	B-spline Curve	176

Chapter 6

SURFACE MODELING

6.1	Three-Dimensional Object Representations.....	186
6.2	Polygon Surfaces	187
6.3	Polygon Table	187
6.4	Plane Equations.....	189

Chapter 7

VISIBLE SURFACE DETERMINATION

7.1	Visible Surface Determination (Hidden Surface Elimination)	194
7.2	Back-Face Detection.....	194
7.3	Depth-Buffer Method (Z-Buffer).....	196
7.4	A-Buffer Method	199
7.5	Scan-Line Method.....	200