BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus

INSTRUCTION DIVISION
SECOND SEMESTER 2014-2015
Course Handout (Part II)

Date: Jan 7, 2015

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **IS F311**
Course Title : **Computer Graphics**
Instructor-in-charge : **Sundaresan Raman** (sundaresan.raman@pilani.bits-pilani.ac.in)
Course webpage : **nalanda.bits-pilani.ac.in**

Course Description:
Graphics I/O hardware; Generation of dot, lines, conics, curves, surfaces & polygons; Filling closed regions, 2D & 3D Graphics & Transformations, Windowing, Viewing & Clipping, Efficient algorithms, Solid Modeling, Color Models & Dithering, Visible surface detection, Rendering, Animation Techniques, Advanced modeling and Future directions

Scope of the Course:
To introduce the underlying concepts in the computer graphics pipeline through theoretical, algorithmic and advanced modeling aspects along with, applications in 3D graphics and visualization. This course also covers basics of OpenGL for graphics. After successful completion of the course student should be able to apply the concepts and techniques to various problem domain and visualization of data sets and processes.

Learning Outcomes:
By doing this course, the students will be able to accomplish the following by the end of the semester.

Given the dimensionality as 2D or 3D, students will be able to delineate and describe all the steps in the graphics pipeline
Given raster display technology, students will be able to describe algorithms for displaying primitives such as line, circle, ellipse or any polynomial function, as well as clipping line segments in 2D/3D
Students will be able to construct matrix for performing any arbitrary transformation such as rotation, translation, given parameters specific to the type of transformation as well as homogenous coordinates.
Students will be able to model/write equations for curves and surfaces given the type of the curve/surfaces.

Students will be able to compute the pixel values of an image given the shading and illumination models employed and required parameters
Students will be able to write programs using OpenGL to display primitives, perform transformations and view them in 2D/3D

Text Book:

T1: James D. Foley, A. Van Dam, S.K. Feiner, and J.F. Hughes, Computer Graphics: Principles and Practice, 2nd ed in C, Addision-Wesley Publishing Company, 1996.

T2: D. Hearn and M.P. Baker, Computer Graphics, C Version, Pearson Education, 2002.

Reference Books:

R1: D. Hearn and M.P. Baker, Computer Graphics with OpenGL Version, (3rd edition), Pearson Education, 2004.

R2: Rogers B., Mathematical Elements of Computer Graphics, Tata McGraw Hill, 2002

Course Plan:

L.No.	Learning Objectives	Topics to be covered	Reference to Text
01-02	Definition Applications I/O Devices	Overview of graphics systems – What, Why & Where about Graphics, Hardware & Software, Input & Output Technology	**T1:** Ch 1 Ch 4.4 **T2:**Ch 1 & 2
03-05	Fast algorithms to draw Lines, Conic, And filled regions	Raster Graphics Algorithms for Drawing 2D objects: Lines, Circle, Ellipse, Parabola, Hyperbola, Polygon & Filled Closed Objects	**T1:** Ch 3.1-3.9 **T2:** Ch 3
06	Introduction to OpenGL	Overview of graphics pipeline, API for OpenGL programming	Class Notes
07-09	How & why to manipulate objects	2D Scaling, Translation, Rotation, Shear, Reflection, Composite Transformations	**T1:** Ch 5 **T2:** Ch 5
10-12	Mapping 2D from World to Screen	Viewing & Clipping in 2D	**T1:** Ch 3.11-3.12, Ch 5.4 **T2:** Ch 6
13-16	3D Concepts	Introduction to 3D- Graphics & 3D Coordinate Geometry, 3D Transformations	**T2:** Ch 9, 11
17-20	Mapping 3D from World to Screen, and Foreshortening	Viewing & Clipping in 3D (Perspective & Parallel projection, Clipping against a Canonical View Volume, Clipping in Homogeneous Coordinates, and Mapping into a View-port	**T1:** Ch 6 **T2:** Ch 12
21-22	OpenGL Functionalities	Hierarchical modeling, OpenGL stacks, projection and 3D viewing	Class Notes
23-27	Drawing Smooth Curves & Surfaces	Hermite, Bezier, Continuities, B-spline Curves & Surfaces Rational Cubic Polynomial Curves & Quadric Surfaces)	**T1:** Ch 11 **T2:** Ch 10
28-30	Representation of	Solid Modeling (Representations, Operations,	**T1:** Ch 12

	Solid Objects	Geometry, and Interface)	
31-33	Detection of Hidden portions	Visible Surface Detection (Need & Algorithms, Ray Tracing) and Hidden Line elimination	**T1:** Ch 15 **T2:** Ch 13
34-37	How to shade surfaces and solids	Rendering (Models, Physics, Shading Polygons & Surface, & Shadows)	**T1:** Ch 16 **T2:** Ch 14
38-39	Perception of light, Color and Dithering	Light & Color Models (Light, Color Models, Color Conversion, half-toning, Dithering Matrix)	**T1:** Ch 13 **T2:** Ch 15
40	How to show graphics in motion	Animation (Languages, Techniques, Control, Basic Rules & Problems)	**T1:** Ch 21

References would be mentioned for OpenGL related material as and when required.

Evaluation Scheme:

Evaluation Component	Weight	Date and Time	Remarks
Mid-semester Exam (90 min)	30%	19/3 2:00 -3:30 PM	Closed Book
Quiz/Assignments	30%	TBA	Take home assignments (Open Book)
Comprehensive Examination (3 hrs)	40%	16/5 FN	Closed Book

Makeup Policy:
If the student misses an evaluation component, he/she may be granted a make-up. In case of an absence that is foreseen, make-up request should be personally made to the Instructor-in-Charge, well ahead of the scheduled evaluation component. Reasons for unanticipated absence that qualify a student to apply for make-up include medical emergencies or personal exigencies. In such an event, the student should contact the Instructor-in-Charge as soon as practically possible.

Academic Conduct Policy:
Students are expected to turn in the submissions in a timely manner. While some components might encourage group learning, this must not be construed as a tacit approval for plagiarism and passive participation.
All students are expected to contribute equally within a team. The instructor's assessment regarding the contributions of team members would be final.
Any use of unfair means in quizzes, assignment, or test/exam will be reported to the Unfair means committee and will be subject to the severe penalty.
Unfair means would include copying from other students or from the Web or from other sources of information including electronic devices
It is expected that all students follow the highest standard of academic practice throughout the running of the course.

Grading Policy:
Award of grades would be guided by the histogram of marks. Decision for cases on borderline of two grades will be based on these criteria: (i) class attendance, participation and responsiveness, and (ii) promptness of submissions. If a student does not give sufficient opportunity for being assessed, either by missing a component entirely or by not applying oneself to the task seriously, he/she may be awarded 'NC' report.

Chamber Consultation Hour:
Wednesday 3:00- 3:50 PM, in cubicle 6121O

Notices:
All notices will be displayed on the course webpage. If there is a need email would be used on short notice (12 hours) – only BITS Pilani email would be used.

Instruction-in-charge
IS C471 / IS F311