STATE UNIVERSITY OF NEW YORK
COLLEGE OF TECHNOLOGY
CANTON, NEW YORK

MASTER SYLLABUS

COURSE NUMBER – COURSE NAME
GMMD 332 – 3D Printing and Design

Created by: Matt Burnett

Updated by: Matt Burnett

Canino School of Engineering Technology

Department: Graphic and Multimedia Design

Semester/Year: Fall/2018

A. **TITLE**: 3D Printing and Design

B. **COURSE NUMBER:** GMMD 332

C. **CREDIT HOURS: (Hours of Lecture, Laboratory, Recitation, Tutorial, Activity)**

 # Credit Hours: 3
 # Lecture Hours: 2 **per week**
 # Lab Hours: 2 **per week**
Other: **per week**

Course Length: 15 **Weeks**

D. **WRITING INTENSIVE COURSE**: Yes ☐ No ☒

E. **GER CATEGORY: None:** ☐ **Yes:** GER 8 The Arts
***If course satisfies more than one*:** GER

F. **SEMESTER(S) OFFERED: Fall** ☐ **Spring** ☐ **Fall & Spring** ☒

G. **COURSE DESCRIPTION:**

This is an immersive course in fused filament fabrication (3d printing) and design. Students will develop their applications of 3-dimensional design through CAD drawing and applications in additive manufacturing. Skills that will be developed include technical knowledge of FFF machines, experience in fabrication with a variety of materials (ABS, PTEG, PLA, NYLON) and digital mesh optimization/repair. Throughout the course students will develop an analytical approach to iterative design and 30 problem solving, preparing for applications in rapid prototyping, on-demand manufacturing, virtual reality, and product customization.

H. **PRE-REQUISITES: None** ☒ **Yes** ☐ **If yes, list below:**

CO-REQUISITES: None ☐ **Yes** ☐ **If yes, list below:**

I. STUDENT LEARNING OUTCOMES: (*see key below*)

By the end of this course, the student will be able to:

Course Student Learning Outcome [SLO]	***Program Student Learning Outcome [PSLO]***	***GER*** *[If Applicable]*	***ISLO & SUBSETS***	
Apply an analytical approach to iterative design concepts using standardized print logs	Design Process	8	1-Comm Skills 2-Crit Think 5-Ind, Prof, Disc, Know Skills	Subsets Subsets Subsets Subsets
Develop designs from concept to digital drawing to mesh to 3 Dimensional object	Design Process	8	2-Crit Think 3-Found Skills ISLO	Subsets Subsets Subsets Subsets
Research additive manufacturing for applications in rapid prototyping, VR, and product customization	Interpretation	8	2-Crit Think 3-Found Skills 5-Ind, Prof, Disc, Know Skills	Subsets Subsets Subsets Subsets
Gain proficiency on several industry standard 3-D design programs and slicing software	Content Knowledge	8	1-Comm Skills 2-Crit Think 5-Ind, Prof, Disc, Know Skills	Subsets Subsets Subsets Subsets
Generate digital meshes from a combination of sources, including open source, CAD design, and scanned structures	Professional Detail	8	2-Crit Think 5-Ind, Prof, Disc, Know Skills ISLO	Subsets Subsets Subsets Subsets
Engage with a team on an integrated project with multiple/interactive parts	Professional Detail	8	5-Ind, Prof, Disc, Know Skills ISLO ISLO	Subsets Subsets Subsets Subsets

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KEY	**Institutional Student Learning Outcomes [ISLO 1 – 5]**
ISLO #	**ISLO & Subsets**
1	**Communication Skills** Oral [O], Written [W]
2	**Critical Thinking** *Critical Analysis [CA] , Inquiry & Analysis [IA] , Problem Solving [PS]*
3	**Foundational Skills** *Information Management [IM], Quantitative Lit,/Reasoning [QTR]*
4	**Social Responsibility** *Ethical Reasoning [ER], Global Learning [GL], Intercultural Knowledge [IK], Teamwork [T]*
5	**Industry, Professional, Discipline Specific Knowledge and Skills**

*Include program objectives if applicable. Please consult with Program Coordinator

J. APPLIED LEARNING COMPONENT: Yes ☒ No ☐

If YES, select one or more of the following categories:

- ☒ Classroom/Lab
- ☐ Internship
- ☐ Clinical Placement
- ☐ Practicum
- ☐ Service Learning
- ☐ Community Service
- ☐ Civic Engagement
- ☐ Creative Works/Senior Project
- ☐ Research
- ☐ Entrepreneurship (program, class, project)

K. TEXTS:

None

L. REFERENCES:

Anderson, Chris Makers: The New Industrial Revolution Crown Business, 2014 978-0307720962

Bernier, Samuel N. Design for 30 Printing: Scanning, Creating. Editing, Remixing and Making in Three Dimensions Maker Media Inc, 181 edition 2015 978-1457187360

Kloski and Kloski, Getting Started with 30 Printing: A Hands-on Guide to the Hardware, Software, and Services Behind the New Manufacturing Revolution Maker Media Inc, May 27 2016 978-1680450200

Redwood, Ben The 30 Printing Handbook: Technologies, Design and Applications 30 Hubs, 1st edition 2017 978-9082748505

Smyth, Clifford Functional Design for 30 Printing; Designing 30 printed things for everyday use---3rd Edition Clifford Smyth; 3rd Edition 2017 978-0692883211

M. EQUIPMENT: None ☐ **Needed:** x

University Supplied 3-D printers, filament, software for CAD design and creating STL fils, software for slicing (print prep) stl files

N. GRADING METHOD: A-F

O. SUGGESTED MEASUREMENT CRITERIA/METHODS:

Projects
Tutorials/Competency Quizzes
Weekly Print Logs
Final Project Presenation

P. DETAILED COURSE OUTLINE:

I. Week 1 - Introduction to Additive Manufacturing

A. Fused Filament Fabrication
B. Other additive processes
C. From idea to STL
D. From STL to Mesh
E. From Mesh to Print

II. Week 2 – Recombination of designs and beginning print considerations

A. Introduction to 3D Design software
B. Additive vs Subtractive design methods
C. Begin tutorials on Google Sketchup
D. First print assignment—"The Crazy Mix"
E. Slicing STLs and preprinting workflow to minimize errors

Ill. Week 3 - Intermediate Printing Methods

A. Customized Manual Supports
B. Checking for Manifold
C. Basic Mesh Repair
D. Begin Tutorials for Adobe Meshmixer
E. 2nd Print Assignment—"The Crazy Crazy Mix"

IV. Week 4. Analytical trouble shooting and iterative design

A. Print Optimization Parameters (Speed, Temperature, layer height, retraction)
B. Print Problem Revisions
C. Variable Material Characteristics (PLA, ABS, PTEG, NYLON)
D. Scientific method as applied to print outcomes
E. 3rd Print Assignment--- "Print parameter Experiment"

V. Week 5. Work time and group presentations of "Print Parameter Experiment"

A. Continue tutorials on Meshmixer and Google Sketchup

VI. Week 6. Functional Design considerations for prototyping

A. Material Tolerances
B. Achieving Accuracy
C. Function and Form
E. The Design process applied to functional prototyping
F. Begin tutorials of 123 Design/Rhino 3D
G. 4th Print Assignment –"Functional Prototype"

VII. Midterm (Practical Exam)

A. Group Presentation/Critique of Functional Prototype
B. Review of Compositional Design Terminology

VIII. Intermediate Techniques/Work time

A. Face Groups
B. Boolean Functions
C. Remeshing/Reducing
D. Optimizing print times/problem solving for a task/assignment
E. Tutorials in Meshmixer and 123 Design/Rhino 3D

IX. 3D Scanning and Translation of Point Cloud to STL

A. Organic Forms
B. Scanner Calibration and function
C. Optimizing Polygon Count
D. Advanced Mesh Repair
E. 5th Print Assignment "Form vs Function ---Organic recombination"
F. Advanced tutorials in CAD design

X. Logo design, branding and product stylizing

A. Versatility of form
B. Normalizing product design style between products -
C.Dual color printing -
D. 6th Print Assignment (group assignment) "Logo design and application across a group of products"

XI. Integration of technology

A. Microprocessors
B. Gopros and imaging
C. Gears, Connectors and other Mechanical applications
D. LEDS

XII. Final Project "Integrated Application of 3D printing"

A. Group proposals presented and revised
B. Worktime

XIII. Worktime & Progress Critiques

XIV. Presentation of Final Projects and critique

Q. <u>LABORATORY OUTLINE</u>: None ☒ Yes ☐