Youngstown
STATE UNIVERSITY

RESOLUTION TO APPROVE
BACHELOR OF ENGINEERING IN MANUFACTURING ENGINEERING

WHEREAS, a Bachelor of Engineering in Manufacturing Engineering degree will serve the needs of people in Northeast Ohio and Western Pennsylvania who wish to earn a degree with an emphasis of manufacturing content in the curricula; and

WHEREAS, manufacturing accounts for the second highest number of regional jobs and is the largest contributor to regional payrolls; and

WHEREAS, the program will reside in the Department of Mechanical and Industrial Engineering; and

WHEREAS, the Department of Mechanical and Industrial Engineering and the College of Science, Technology, Engineering, and Mathematics possesses the essential facilities to allow for the addition of said program; and

WHEREAS, Youngstown State University has faculty members with the requisite credentials to offer this degree; and

WHEREAS, it is the intention of the Department of Mechanical and Industrial Engineering to seek accreditation for the degree through ABET, Inc.; and

WHEREAS, the resources for the administration of this degree currently exist in the College of Science, Technology, Engineering, and Mathematics;

NOW, THEREFORE, BE IT RESOLVED, that the Board of Trustees of Youngstown State University approves the offering of the Bachelor of Engineering in Manufacturing Engineering degree, subsequent to the approval of said degree by the Ohio Department of Higher Education.

YSU Program Proposal – Narrative

B.E. in Manufacturing Engineering

A. Indicate the title of the proposed program, and indicate whether it is a new degree, a new degree program and/or option within an existing program, or modification of an existing program.

Manufacturing Engineering – The proposed curriculum is a new degree program to be offered by the Department of Mechanical and Industrial Engineering. (A departmental name change is also being explored to make it the Department of Mechanical, Industrial, and Manufacturing Engineering – MIME.)

B. State the rationale for initiating this action.

Manufacturing is a cornerstone of the national economy and a key economic driver for this region. Over the past 40 years, manufacturing has shifted from a labor-intensive industry to a technology-intensive industry. Per-capita output has increased dramatically through improved processes and systems. To remain competitive, manufacturers rely on a skilled workforce that is able to function effectively within this evolving manufacturing paradigm.

With the advent of Additive Manufacturing (AM), also known as 3D printing, the rate of evolution of manufacturing has dramatically increased. With at least seven (7) new fundamental process families added to the five or so processes traditionally used in manufacturing, the complexity of component design and manufacturing options has increased exponentially. Companies require engineering support to assist them in making appropriate choices for product design and process selection based on the full range of current and emerging process options.

Manufacturing Engineering as a standalone discipline is relatively younger than its cousins, Mechanical Engineering and Industrial Engineering. It sits squarely between the two disciplines, incorporating the fundamentals of mechanical engineering for understanding process mechanics and material behaviors while drawing upon the emphases of modern industrial engineering to support systems level integration and an optimization philosophy.

The TechBelt region, spanning roughly from Pittsburgh to Cleveland, represents one of the most heavily industrialized and productive manufacturing regions in the nation. Even so, there are almost no programs in the region to support manufacturing engineering. Based on a recent search on the Ohio Means Jobs website, there were 35 current, unfilled job opening for "Manufacturing Engineer" within a 50 mile radius of Youngstown State University. There are currently only 20 accredited manufacturing engineering programs in the entire country, only one of which is in the state of Ohio (Miami of Ohio). The nearest accredited program is in Pittsburgh at Robert Morris University.

With its historical roots in manufacturing, and with its prominent association with the nation's first National Manufacturing Institute, America Makes, Youngstown State University is uniquely positioned at this time to establish a best-in-class manufacturing program that will attract students from around the country and that will serve as a source for highly skilled manufacturing engineering professionals to support the regional, state, and national manufacturing industries.

C. Provide information regarding the relationship of the proposed program action to the overall mission of the institution. Indicate whether the program is a part of an ongoing traditional mission, or related to current strategies for modifying or redirecting institutional objectives.

YSU, in its commitment as an urban research university, has a mission to serve both its students and the region. The proposed program in Manufacturing Engineering is responsive to the current and future workforce needs of the region's manufacturers. It complements YSU's substantial commitment to manufacturing and builds upon the unique opportunities afforded to YSU through its relationship with America Makes – the National Additive Manufacturing Innovation Institute.

The manufacturing industry contributes more than $2-trillion to the U.S. economy. The State of Ohio represents nearly 5% of that contribution. Representing 35% of the state's manufacturing output, Northeast Ohio manufacturing is a critical economic driver. [1] As manufacturing continues to evolve from a labor-intensive profession to one driven by technology, the workforce continues to evolve as well. This is reflected in the high demand for manufacturing engineers and the high wages for manufacturing professionals. Ohio's Department of Jobs and Family Services has identified Manufacturing Engineers as one of the most in-demand occupations in the state. There is a need within the state to fill 120 positions each year, and the median salary for those holding a bachelor's degree is $84,060.[2]

Youngstown State University has worked closely with representatives from the Mahoning Valley Manufacturer's Coalition, the OH-PENN Manufacturing Coalition, Eastern Gateway Community College, and regional career and technical centers to identify the workforce needs in manufacturing. The proposed program will be part of an integrated career pathways network that supports stackable credentials and career ladders. Through this program and those relationships, students who might not have recognized the opportunities available to them in advanced manufacturing careers may enter the workforce pipeline at their current level of training and may grow to whatever level of academic attainment suits their ambitions.

D. Indicate the proposed implementation date for this action.

Implementation of the program is anticipated for Fall 2016.

E. Indicate the department(s) or other organizational unit(s) responsible for this program.

The Department of Mechanical and Industrial Engineering

F. Describe, in catalog style, the program, including each concentration or option. Include program level outcomes and a table listing all courses in the major and the number of semester hours for each, plus the total number of hours for the program (and subtotals if there are categories within the program), including the number of hours of general education required beyond the major. Indicate any prerequisites that students must take that do not apply toward the major. Also indicate approved capstone course within the major. If the proposed change is an additional option within an existing program, be explicit about how the new option differs from the original program and/or other options within the program. If the proposed change is a modification of an existing program, include both old

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[1] [1] Bureau of Economic Analysis – Regional Data, GDP and Personal Income – Accessed 7/14/2015 - http://bea.gov/itable/iTable.cfm?ReqID=70&step=1#reqid=70&step=10&isuri=1&7003=200&7035=-1&7004=naics&7005=-1,12,70&7006=00000,39000&7036=-1&7001=1200&7002=1&7090=70&7007=2014&7093=levels

[2] Ohio Means Jobs.com – All In Demand Occupations – Accessed 10/1/2015 - http://jfs.ohio.gov/owd/OMJResources/State-AllWages.stm

and new curriculum sheets, and indicate the specific changes, both in an accompanying description and by bolding or shading within the curriculum sheets. Please note: Attach course proposals for any new courses or proposed course revisions within the program. You may submit forms simultaneously to the Academic Programs Committee (APC) and the Undergraduate Curriculum Committee (UCC), but you must provide documentation that the revised or new courses have been approved by the UCC before the APC can approve a program proposal.

1. **Program Description**

The Bachelor of Engineering degree in Manufacturing Engineering provides students with expertise that focuses on the processes needed to produce physical goods and materials. Students will gain a strong foundation in materials, mechanical engineering, and design to support their understanding of the mechanics of processes. They will also gain foundational understanding of industrial engineering concepts to support their ability to optimize production systems for maximum efficiency. Topics will include traditional manufacturing as well as modern digital manufacturing (additive manufacturing / 3D printing) processes and automation. Graduates from this program will be well prepared for careers in a wide range of industries including: traditional manufacturers, primary materials producers, and high-tech manufacturing (including defense, aerospace, and biomedical).

2. **Program level outcomes**

The goal of the B.E. in Manufacturing Engineering degree program at YSU is to provide our graduates with a strong foundation of theoretical and applied skills equipping them for success to pursue careers in manufacturing or to continue on to advanced study in a related field.

The learning objectives for the major in Manufacturing Engineering include:

(1) Students will demonstrate an understanding of the fundamentals of manufacturing engineering, including significant elements from Mechanical Engineering, Industrial Engineering, and manufacturing process design and analysis.
(2) Students will demonstrate independent and critical thinking.
(3) Students will demonstrate competency in the use of modern engineering computational tools including solid modeling and finite element analysis software.
(4) Students will be able to acquire and interpret experimental data using appropriate instrumentation, sensing, data acquisition, and computational tools.
(5) Students will demonstrate the ability to effectively communicate information orally and in writing.

3. **Table listing all courses in the program (major courses in BOLD)**

Total Hours Required: 128 s.h. *(Note: Though this number exceeds the University recommended 124 hours, it is consistent with both other engineering programs at YSU as well as at other universities and reflects the depth/breadth requirements of the program.)*

GER Hours: *39*
Capstone Hours: *3 (MFG 4821)*

Course (name / number)	credit hours (s.h.)	Major / Core / Technical	Gen. Ed.	Elective	OTM, TAG, or CT2 equivalent Course	New / Existing Course
CEEN 2601 Statics	3	X				Existing
CHEM 1515 General Chemistry 1 (GER, NS)	4		X		X	Existing
CMST 1545 Communication Foundations (GER, O)	3		X			Existing
ECEN 2614 Basis of Electrical Engineering	3	X				Existing
ENGL 1550 Writing 1 (GER, W)	3		X			Existing
ENGL 1551 Writing 2 (GER, W)	3		X			Existing
ENGR 1500 Engineering Orientation	1	X				Existing
ENGR 1550 Engineering Concepts	2	X				Existing
ENT 3700 - Entrepreneurship New Venture Creation	3			x		Existing
GER Elective (SPA) 1	3		X			Existing
GER Elective (AH) 1	3		X			Existing
GER Elective (AH) 2	3		X			Existing
GER Elective (SPA) 2	3		X			Existing
GER Elective (SS) 1	3		X			Existing
GER Elective (SS) 2	3		X			Existing
ISEN 3710 Engineering Statistics *	3	X				Existing
ISEN 3716 Systems Analysis and Design	3	X				Existing
ISEN 3720 Statistical Quality Control	3	X				Existing
ISEN 3724 Engineering Economy	3	X				Existing
ISEN 5823 Automation	3	X				Existing
MATH 1571 Calculus 1 (GER, MA)	4		X		X	Existing
MATH 1572 Calculus 2 (GER, MA)	4		X		X	Existing
MATH 2673 Calculus 3	4	X				Existing
MATH 3705 Differential Equations	3	X				Existing
MECH 1560 Engineering Communication with CAD	2	X				Existing
MECH 2603 Thermodynamics 1	3	X				Existing

MECH 2606 Engineering Materials	3	X				Existing
MECH 2641 Dynamics	3	X				Existing
MECH 3720 Fluid Dynamics	3	X				Existing
MECH 3762 Design of Machine Elements	3	X				Existing
MECH 3762L Design of Machine Elements Laboratory	1	X				Existing
MECH 5836 Fluid Power and Control	3	X				Existing
MET 3710. Tool Design	3	X				
MFG 3723 Manufacturing Processes	3	X				New
MFG -3723L - Manufacturing Processes Laboratory	1	X				New
MFG-3771 –Additive and Digital Manufacturing	3			X		New
MFG 4821 –Manufacturing Capstone	3	X				New
MFG-4823 – Advanced Manufacturing Processes	3	X				New
MFG-4823/L - Advanced Manufacturing Processes Laboratory	1	X				New
MFG-4861 – Design for Manufacturability	3	X				New
MFG 5871 – Stress, Plasticity, and Deformation (with FEA)	3			X		New
PHIL 2626 Engineering Ethics (GER, AH)	3		X			Existing
PHYS 2610 General Physics 1 (GER, NS)	4	X			X	Existing
PHYS 2611 General Physics 2 (GER, NS)	4	X			X	Existing

Major Course Descriptions:

CEEN 2601 – Statics – Principles of engineering mechanics as applied to statics with vector applications to forces and moments; centroid and center of gravity; equilibrium; friction; moments of inertia: relationship between loads, stress and strain in tension, compression, torsion and bending. Prereq.: MATH 1572 and PHYS 2610 or concurrent. 3 s.h.CHEM 1515 Chem 1 (GER, NS)

CMST 1545 - Communication Foundations -- Theories, strategies, and skills for competent participation in interpersonal, group, and public communication situations. Application exercises in interpersonal, group, and public communication. Prereq.: Qualified to take ENGL 1550. 3 s.h.ECEN 2614 Elec Engr Basics

ENGL 1550 - Writing 1- Strategies for writing as a means of critical inquiry, with focus on writing processes and on the roles of writer, audience, and purpose as they affect writing. Students divide their time between regular classrooms and computer classrooms, where they have the opportunity to acquire and develop basic word-processing and electronic communication skills. Open to students on the basis of Composition and Reading Test results or successful completion of ENGL 1509, ENGL 1539 or ENGL 1540. Grading is ABC/NC. 3 s.h.

ENGL 1551 - Writing 2 -- Practice in writing with emphasis on the process of investigation: exploration of topics, formulation of tentative theses, collection of data from suitable primary and secondary sources, and clear and appropriate presentation of the results of these inquiries. Students divide their time between regular classrooms and computer classrooms, where they have the opportunity to perform research on the World Wide Web. Grading is ABC/NC. Prereq.: ENGL 1550 or ACT English score of 28 or higher, or appropriate Composition and Reading Test results. 3 s.h.

ENGR 1500 - Engr Orientation - Introduction to engineering careers and the different engineering disciplines. Academic success strategies and university resources to support student success. 1 s.h.

ENGR 1550 - Engineering Concepts -- Introduction to the basic skills needed in engineering including engineering computing and an introduction to the engineering design process utilizing science, technology, engineering, and mathematics (STEM) fundamentals. One hour lecture and three hours laboratory per week. Prereq.: Eligibility to take MATH 1513 or higher level math course. 2 s.h.

ENT 3700 - Entrepreneurship New Venture Creation - An examination of the entrepreneurial process from opportunity recognition and assessment through the launch of the new firm. Emphasis placed on exploring creativity and innovation. Students will develop a feasible business idea, present the idea as an elevator pitch, and write a business proposal. Prereq.: BUS 1500; sophomore standing; GPA 2.5. 3 s.h.

ISEN 3710 - Engineering Statistics -- Applications of data collection and analysis techniques to engineering problems. Techniques for data structuring, data modeling, parameter estimation, and design of experiments utilizing engineering data. Prereq.: MATH 1571. 3 s.h.

ISEN 3720 - Statistical Quality Control - Concepts of data-based quality control techniques. Intermediate design of experiments as an off-line quality control technique using ANOVA techniques. Process control chart construction and applications as on-line quality control techniques. Basics of acceptance sampling systems and standards. Prereq.: ISEN 3710 or equivalent. 3 s.h.

ISEN 3724 - Engineering Economy -- The analysis and evaluation of factors that affect the economic success of engineering projects. Topics include interest, depreciation, cost classification, comparison of alternatives, make-buy decisions, replacement models and after-tax analysis. Prereq.: MATH 1571. 3 s.h.

ISEN 5823 – Automation -- Principles and applications of sensing, actuation and control. Emphasis on hydraulic and pneumatic systems. Industrial process controllers, sensors and machine vision. Design and cost considerations for industrial automation applications. Prereq.: MECH 2641, ECEN 2614 or consent of instructor. 3 s.h.

MATH 1571, 1572. Calculus 1, 2. A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications. Prereq.: MATH 1571 requires at least Level 70 on the Mathematics Placement Test, or MATH 1513. MATH 1571 for MATH 1572. 4 + 4 s.h.

MATH 2673 - Calculus 3 -- A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications. Prereq.: MATH 1572. 4 s.h.

MATH 3705 - Differential Equations -- Methods and theory of solving differential equations with applications. Existence, uniqueness. First order equations. Higher order linear equations. Introduction to partial differential equations and boundary value problems, including Laplaces equation. Prereq.: MATH 2673. 3 s.h.

MECH 1560 - Engineering Communication with CAD -- Commercially available software typically used in engineering practice will be used to develop traditional 2D engineering drawings and 3D solid models representing engineering components and systems. Teams of students will complete an engineering design project. One hour lecture and three hours laboratory per week. Prereq.: ENGR 1555 or concurrent. 2 s.h.

MECH 2603 - Thermodynamics 1 -- Thermodynamic properties of gases and vapors, and their relationships in energy transformations. The First and Second Laws of thermodynamics. Introduction to thermodynamic cycles and efficiencies of power and refrigeration systems. Prereq.: MATH 1572, CHEM 1515. 3 s.h.

MECH 2606 - Engineering Materials -- Properties and uses of engineering materials, manufacturing processes, including heat treatments and forming operations. Introduction to mechanical testing methods. Listed also as MTEN 2606. Prereq.: MATH 1571. 3 s.h.

MECH 2641 – Dynamics -- Kinematics of particles and rigid bodies. Newtons laws of motion, work-energy, and impulse momentum techniques applied to particle and rigid body motion using a vector approach. Prereq.: CEEN 2601. 3 s.h.

MECH 3720 - Fluid Dynamics -- Study of stationary fluids, and fluid dynamics of compressible and incompressible flows; dimensional analysis; boundary layers; subsonic and supersonic flows; lift and drag on bodies immersed in incompressible flows. Prereq.: MECH 2604, MATH 3705, MECH 2641. 3 s.h.

MECH 3762 - Design of Machine Elements -- Application of fundamental engineering principles to the design of various elements found in machines. Elements include connections, shafts, keys, couplings, springs, gears, belts, chains, bearings, clutches, brakes, screws, etc. Prereq.: MECH 2641 and 3751. Must be taken concurrently with MECH 3762L. 3 s.h.

MECH 3762L - Design of Machine Elements Laboratory -- Practical design problems incorporating analysis, material selection, and sizing of machine components utilizing the computer. Three hours laboratory per week. Must be taken concurrently with MECH 3762. 1 s.h.

MECH 5836 - Fluid Power and Control -- Theory of prime movers, turbomachinery, and control systems. Modeling of hydraulic and pneumatic systems and components. Hydraulic fluids, pumps, cylinders, valves, motors, compressors, and actuators. Hydraulic and pneumatic circuit applications and control. Prereq.: MECH 3725. 3 s.h.

MET 3710 - Tool Design -- Design and selection of cutting tools, fixtures, bending and forming dies, inspection and gauging instruments, and material feed mechanisms. Two hours lecture, three hours lab per week. Prereq.: C or better in MET 3707. 3 s.h.

ISEN 3723 - Manufacturing Processes -- Introduction to properties and uses of engineering materials. Introduction to mechanical testing methods, metrology, tolerances, testing and inspection; semi-finished product manufacturing; macro-processing (forming, casting, powder metallurgy, metal working, composite fabrication); joining; nontraditional manufacturing processes; and surface processing. Prereq. Math 1572 and MECH 2606. 3 s.h.

MFG -3723/L - Manufacturing Processes Laboratory - Laboratory to accompany MFG 3723. Students will gain hands-on experiences with basic manufacturing processes, mechanical testing methods, metrology equipment. Prereq. or concurrent MFG 3723. 1 s.h.

MFG 3771 – Additive and Digital Manufacturing – Introduction to the principles and practices of digital manufacturing with emphasis on additive manufacturing processes. Historical and modern perspectives on geometric representation and file formats. Toolpath generation. Capabilities, limitations, and design criteria for additive manufacturing processes. Digital representation of part geometries. Pre-processing, post-processing, and inspection of additively manufactured parts. Contemporary issues of data management for digital manufacturing. Prereq.: MFG 3723. 3 s.h.

MFG 4821 – Manufacturing Capstone – The application of manufacturing engineering techniques to real-world, open-ended questions. Problems will include elements of process and component analysis and design and will incorporate manufacturability, performance, and cost criteria. Design exercises will include data gathering, simulation, prototyping, and design verification. Students will be required to submit a final written report and accompanying technical documentation, including drawings. Grading is Traditional/PR. Prereq or concurrent MFG 4823 and MFG 4861 and 96 credits s.h. of engineering degree credit. 3 s.h.

MFG-4823 – Advanced Manufacturing Processes – Broad discussion of manufacturing processes and underlying phenomena with analytical methods. Builds upon foundational understanding of processes established in MFG 3723 and focuses on the development of appropriate mathematical models to predict process parameters and effects on produced geometries and material properties. Prereq.: ISEN 3723 and must be taken concurrently with MFG 4823/L. 3 s.h.

MFG-4823/L - Advanced Manufacturing Processes Laboratory – Laboratory to accompany Manufacturing Processes II. Experimental validation of manufacturing process analyses. Experimental design methods. Data collection, process automation, monitoring and control. Prereq.: must be taken concurrently MFG 4823. 1 s.h.

MFG-4861 – Design for Manufacturability – Introduction to the concepts of "Design for X" with particular emphasis on Design for Manufacturability and Assembly (DFMA). Implications of emerging additive manufacturing processes and associated Design for Additive Manufacturing (DFAM) principles will be discussed. Prereq.: MFG 3723 3 s.h.

MFG 5871 -- Stress, Plasticity, and Deformation (with FEA) for Manufacturing – Theories of deformation, stress-strain relationships, and emphasis on mechanisms and models of plastic deformation. Simulation of elastic / plastic deformation using finite element computational methods. Prereq.: MFG 3723. 3 s.h.

PHIL 2625 - Introduction to Professional Ethics -- An examination of the ideals and virtues central to professionalism; study of selected codes of professional ethics and their roots in classical ethical traditions; and analysis of selected ethical issues and problems in a variety of professions. 3 s.h.

PHYS 2610. General Physics 1. A course in mechanics; the kinematics and dynamics of masses in translation and rotation; Newtons Laws; gravity; the conservation laws of energy and momentum; simple harmonic motion and introduction to wave motion and sound. Prereq.: High school physics or PHYS 1501. Prereq. or concurrent: MATH 1571. 4 s.h.

PHYS 2611. General Physics 2. Study of electric and magnetic fields and their effects; introduction to electric circuits; light as an electromagnetic wave; introduction to geometrical and physical optics. Prereq.: PHYS 2610. Prereq. or concurrent: MATH 1572. 4 s.h.

Program Sequence

Time period	Curriculum component	Time period	Curriculum component
Year 1	**Courses/Activities**	**Year 1**	**Courses/Activities**
Fall Semester	CHEM 1515 Chem 1 (GER, NS)	Spring Semester	CMST 1545 Speech (GER, O)
	ENGL 1550 Writing 1 (GER, W)		ENGL 1551 Writing 2 (GER, W)
	ENGR 1500 Engr Orientation		MATH 1572 Calc 2 (GER, MA)
	ENGR 1550 Engr Concepts		MECH 1560 Engr Comm w/CAD
	MATH 1571 Calc 1 (GER, MA)		PHYS 2610 Phys 1 (GER, NS)
	GER Elective (SPA) 1		
Time period	**Curriculum component**	**Time period**	**Curriculum component**
Year 2	**Courses/Activities**	**Year 2**	**Courses/Activities**
Fall Semester	CCET 2601 Statics	Spring Semester	ECEN 2614 Elec Engr Basics
	MATH 2673 Calculus 3		ISEN 3716 Sys. Anal. and Design
	MECH 2606 Engineering Materials		MATH 3705 Diff Equations
	PHYS 2611 Phys 2 (GER, NS)		MECH 2603 Thermodynamics 1
	ISEN 3723 Manu Proc		MECH 2641 Dynamics
	MFG -3723L - Manufacturing Processes Laboratory		
Time period	**Curriculum component**	**Time period**	**Curriculum component**
Year 3	**Courses/Activities**	**Year 3**	**Courses/Activities**
Fall Semester	MFG 3771 - Additive and Digital Manufacturing	Spring Semester	ISEN 3720 Stat Qual Cont
	ISEN 3724 Engineering Economy		GER Elective (SPA) 2
	ISEN 3710 Engr Statistics *		GER Elective (SS) 1
	MECH 3720 Fluid Dyn		GER Elective (SS) 2
	MECH 3762 Machine Design		ISEN 3720 Stat Qual Cont
	MECH 3762L Mach Des Lab		
Time period	**Curriculum component**	**Time period**	**Curriculum component**
Year 4	**Courses/Activities**	**Year 4**	**Courses/Activities**
Fall Semester	GER Elective (AH) 2	Spring Semester	GER Elective (AH) 1
	PHIL 2625 Prof Ethics (GER, AH)		ISEN 5823 CAM & Automation
	MFG-4823 – Advanced Manufacturing Processes		MECH 5836. Fluid Power and Control
	MFG-4823/L - Advanced Manufacturing Processes Laboratory		ENT 3700 - Entrepreneurship New Venture Creation
	MFG 5871 - Elective - Stress, Plasticity, and Deformation (with FEA) - for Manufacturing		MFG 4821 – Manufacturing Capstone
	MFG-4861 –Design for Manufacturability		MFG Technical Elective (Select from List)

4. Curriculum Proposals

Attached as "YSU Program Proposal - Appendix A".

G. Provide details regarding the source of students. Provide estimates of the numbers of students (FTE) expected to enroll in the proposed program over the next four-year period. Indicate whether these will be current students or new students, and how many are estimated to be full-time and/or part-time.

Initial enrollment will include attraction of some current students to the program. However, because this program will be nationally prominent in an exciting and rapidly growing field, this program is expected to have broad recruiting appeal for both regional and extra-regional students.

Year:	2016-2017	2017-2018	2018-2019	2019-2020
Total Enrollment:	4	10	18	28
FT / PT	4/0	10/0	18/0	28/0
Current / New	2/2	4/6	5/13	6/22

H. Indicate the availability of other such programs within fifty miles.

There are no other manufacturing engineering programs within 50 miles. There is only one other such program in the state (Miami University in Oxford, Ohio). The nearest manufacturing engineering program is at Robert Morris University in Moon, Pennsylvania.

I. Describe the impact this program will have on facilities, faculty, and support services.

The growth in manufacturing equipment and facilities needs are already present in our existing teaching and research programs and will continue to grow with or without the development of a Manufacturing Engineering degree program. As such, it is not anticipated that the formal creation of such a program will significantly alter those needs. As this program will build upon our successful and rapidly growing multidisciplinary activities in manufacturing, it will provide a common theme around which to organize our efforts in equipment acquisition. It will strengthen our ability to successfully pursue infrastructure to support not only the Manufacturing Engineering program but also many related disciplines across the university.

The core faculty members needed to initiate this program are already in place. The most recent four hires within the Industrial and Systems Engineering program have all been principally from a manufacturing background and will serve as the primary faculty for the program. Additionally, several of the recent hires in Mechanical Engineering as well as several of the senior faculty in both ME, IE, and MET all have relevant backgrounds and will be able to support the program as appropriate.

The program that will be most significantly impacted by the establishment of this degree program is industrial engineering. It is expected that the manufacturing faculty will continue to support the manufacturing components of the IE curriculum, consistent with their various backgrounds in manufacturing and materials science. As enrollment between the two programs grows, it is reasonable to expect that additional faculty resources in both programs may be required.

General support services (computing, classroom support, etc.) are not anticipated to change significantly as a result of the establishment of the manufacturing program. Support services unique to manufacturing engineering (laboratory technician) will be required regardless of the establishment of

the program and will be principally provided as part of the planned Innovation Complex being developed in cooperation with STEM and WCBA.

J. Estimate total costs, over and above current levels of operation, associated with this proposed program during the next four years.

The core Manufacturing Engineering faculty will be drawn from the Mechanical and Industrial Engineering programs. Because the curricula of the three programs (ME, IE, and MFG) overlap so heavily, these faculty will continue to support the two existing programs with their current course offerings. However, the additional courses offered in the MFG program will require some amount of supplemental teaching capabilities to enable the faculty to develop and deliver the new curriculum.

The core faculty are also very actively involved in externally funded projects, having collectively brought in more than $8-million of funding over the past 5 years. This rate of production is expected to continue for the foreseeable future and will be an important element of the growth and sustainment of the Manufacturing Engineering program. As such, it is expected that there will need to be additional full-time faculty brought on board by the third year of the program.

Expenses for additional faculty resources have been budgeted at a fully-burdened rate of $50k/ year in Year 1 and Year 2 to cover approximately 12 s.h. / year (1/2 FTE) of limited service teaching to offset the additional teaching loads. An additional full-time faculty member would be expected to be brought on board in Year 3 at a budgeted fully-burdened cost of $130k/year.

The nature of the program will require that students have access to substantial materials and resources to support project work, especially in their capstone projects. A budgetary estimate of $5k-$10k has been included to allocate funds for that purpose.

Estimated New Costs:

Year:	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**
Limited Service Faculty	$50,000	$50,000		
Full-Time Faculty			$130,000	$130,000
Materials	$5,000	$5,000	$7,500	$10,000
Total New Costs:	**$55,000**	**$55,000**	**$137,500**	**$140,000**

K. Review the potential impact of the program change on minors in your department or in other departments. Is there an impact, and if so, what is the impact? (Check any official minors in your program or affecting other departments and programs to see if you need to change a minor based on changes in the program.)

There is not expected to be any appreciable negative impact on minors in our department or others. Any students pursuing a minor in Industrial Engineering would still be supported by the Manufacturing Engineering courses relevant to their minor. A possible positive impact on minors may be that the manufacturing program, by straddling the space between mechanical and industrial engineering, may provide a bridge to entice more students to consider minors.

YSU Program Proposal

Appendix A - New Course Proposals

- MFG 3723 – Manufacturing Processes
- MFG 3723/L – Manufacturing Processes Laboratory
- MFG 3771 – Additive and Digital Manufacturing
- MFG 4821 – Manufacturing capstone
- MFG 4823 – Advanced Manufacturing Processes
- MFG 4823/L – Advanced manufacturing processes laboratory
- MFG 4861 – Design for Manufacturability
- MFG 5871 – Stress, plasticity, and deformation (with FEA)

Course Proposal – MFG 3723

Course Proposal –

What do you want to do? Change / **Add** / Delete / View

New Course Information

Course Prefix MFG

Course Number 3723

Course Title Manufacturing Processes

Title Abbreviation

Course Description Introduction to properties and uses of engineering materials. Introduction to mechanical testing methods, metrology, tolerances, testing and inspection; semi-finished product manufacturing; macro-processing (forming, casting, powder metallurgy, metal working, composite fabrication); joining; nontraditional manufacturing processes; and surface processing.

Prerequisites Math 1572 and MECH 2606

Do you want variable credit? No

Course Semester Hours 3

Is this a semester lab? No

E-bulletin

Workload **Entry manually**

Choose from list

CIP Code

CIP Code Family: 14

CIP Code 14.3601

Course Type (press Ctrl to select more than one) **Lecture** / Seminar / Recitation / Lab

Justification and Syllabus:

Justify Course Proposal : This course is being added to serve as the introductory manufacturing course for YSU engineering students, particularly those in Industrial Engineering and the newly formed Manufacturing Engineering. With the creation of a Manufacturing Engineering program, it is more appropriate that this course be offered under that program.

*** Faculty :** Dr. Darrell Wallace, Dr. Brett Conner, Dr. Guha Manogharan

Syllabus (Attached)

Cross Listing

Cross List? No

Proposal and Memo

Will proposal affect another department? No

ABET SYLLABUS - MFG 3723

1. Course number and name: MFG 3723 – Manufacturing Processes

2. Credits and contact hours: 3 s.h.

3. Instructor or course coordinator's name: Darrell Wallace

4. Textbook, title, author, and year:

Mikell P. Groover, Fundamentals of Modern Manufacturing, 5th Ed., , Wiley, 2012

4.a. Other supplemental materials: course handouts

5. Specific course information

a. brief description of the content of the course (catalog description):

Introduction to properties and uses of engineering materials. Introduction to mechanical testing methods, metrology, tolerances, testing and inspection; semi-finished product manufacturing; macro-processing (forming, casting, powder metallurgy, metal working, composite fabrication); joining; nontraditional manufacturing processes; and surface processing.

b. prerequisites or co-requisites Prereq. Math 1572 and MECH 2606.

c. indicate whether a required or elective course in the program: Required

6. Specific goals for the course:

- The student will demonstrate the ability to identify appropriate processes to achieve desired geometric and performance properties for a particular material.
- The student will demonstrate the ability to identify likely methods of manufacturing used to produce a given physical artifact.
- The student will be able to perform basic engineering analyses of manufacturing processes to determine force, energy, performance, and costs associated with a process.
- Student will demonstrate an understanding of the effects of processing on material properties.

7. Explicitly indicate which of the student outcomes listed in Citerion 3 or any other outcomes are addressed by the course:

a. an ability to apply knowledge of mathematics, science and engineering

b. an ability to design and conduct experiments, as well as to analyze and interpret data

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d. an ability to function on multidisciplinary teams

e. an ability to identify, formulate, and solve engineering problems

f. an understanding of professional and ethical responsibility

g. an ability to communicate effectively (3g1 orally, 3g2 written)

h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

i. a recognition of the need for, and an ability to engage in life-long learning

j. a knowledge of contemporary issues

k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

8. Brief list of topics to be covered:

- Material properties
- Solidification processes
- Material removal processes
- Deformation processes (bulk and sheet)
- Polymer processes
- Welding and joining processes
- Fastening and assembly
- Design for Manufacturability

Course Proposal – MFG 3723/L

What do you want to do? Change / **Add** / Delete / View

New Course Information

Course Prefix MFG

Course Number: 3723/L

Course Title: Manufacturing Processes Laboratory

Title Abbreviation :

Course Description: Laboratory to accompany MFG 3723. Lab provides hands-on experience with basic manufacturing processes including: casting, forming, machining, welding, and injection molding.

Prerequisites: Prereq. or concurrent MFG 3723

Do you want variable credit? No

Course Semester Hours 1

Is this a semester lab? Yes

E-bulletin

Workload **Entry manually**

Choose from list

CIP Code

CIP Code Family: **14**

CIP Code **14.3601**

Course Type (press Ctrl to select more than one) Lecture / Seminar / Recitation / **Lab**

Justification and Syllabus:

Justify Course Proposal

This course is being added to serve as the introductory manufacturing course for YSU engineering students, particularly those in Industrial Engineering and the newly formed

Manufacturing Engineering. With the creation of a Manufacturing Engineering program, it is more appropriate that this course be offered under that program.

Faculty: Dr. Darrell Wallace, Dr. Brett Conner, Dr. Guha Manogharan

Syllabus: Attached

Cross Listing

Cross List? No

Proposal and Memo:

Will proposal affect another department? No

ABET SYLLABUS - MFG 3723/L

1. Course number and name: MFG 3723/L – Manufacturing Processes Lab

2. Credits and contact hours: 1 s.h.

3. Instructor or course coordinator's name: Darrell Wallace

4. Textbook, title, author, and year:

Mikell P. Groover, Fundamentals of Modern Manufacturing, 5th Ed., , Wiley, 2012

4.a. Other supplemental materials: course handouts / lab manual

5. Specific course information

a. brief description of the content of the course (catalog description):

Laboratory to accompany MFG 3723. Lab provides hands-on experience with basic manufacturing processes including: casting, forming, machining, welding, and injection molding.

b. prerequisites or co-requisites Prereq. or concurrent MFG 3723

c. indicate whether a required or elective course in the program: Required

6. Specific goals for the course:

- Student will demonstrate basic understanding of fundamental manufacturing processes including: casting, machining, forming,

7. Explicitly indicate which of the student outcomes listed in Citerion 3 or any other outcomes are addressed by the course:

a. an ability to apply knowledge of mathematics, science and engineering
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
e. an ability to identify, formulate, and solve engineering problems
k an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

8. Brief list of topics to be covered:

- Material properties

- Solidification processes
- Material removal processes
- Deformation processes (bulk and sheet)
- Polymer processes
- Welding and joining processes
- Fastening and assembly
- Design for Manufacturability

Course Proposal – MFG 3771

What do you want to do? Change / **Add** / Delete / View

New Course Information

Course Prefix MFG

Course Number 3771

Course Title Additive and Digital Manufacturing

Title Abbreviation

Course Description Introduction to the principles and practices of digital manufacturing with emphasis on additive manufacturing processes. Historical and modern perspectives on geometric representation and file formats. Toolpath generation. Capabilities, limitations, and design criteria for additive manufacturing processes. Digital representation of part geometries. Pre-processing, post-processing, and inspection of additively manufactured parts. Contemporary issues of data management for digital manufacturing. Prereq.: MFG 3723. 3 s.h.

Prerequisites MFG 3723

Do you want variable credit? No

Course Semester Hours 3

Is this a semester lab? No

E-bulletin

Workload **Entry manually**

Choose from list

CIP Code

CIP Code Family: 14

CIP Code 14.3601

Course Type (press Ctrl to select more than one) **Lecture** / Seminar / Recitation / Lab

Justification and Syllabus:

Justify Course Proposal : This course addresses the most significant and rapidly growing segment of manufacturing technologies. This is the dominant growth area in manufacturing and is not covered in-depth anywhere else in the YSU curricula.

*** Faculty :** Dr. Darrell Wallace, Dr. Brett Conner, Dr. Guha Manogharan

Syllabus (Attached)

Cross Listing

Cross List? No

Proposal and Memo

Will proposal affect another department? No

ABET SYLLABUS – MFG 3771

1. Course number and name: MFG 3771

2. Credits and contact hours: 3 s.h.

3. Instructor or course coordinator's name: Darrell Wallace

4. Textbook, title, author, and year: Additive Manufacturing Technologies (2010; Springer) by Brent Stucker , David Rosen , and Ian Gibson ISBN 978-1-4419-1120-9

4.a. Other supplemental materials: course handouts

5. Specific course information

a. brief description of the content of the course (catalog description): Introduction to the principles and practices of digital manufacturing with emphasis on additive manufacturing processes. Historical and modern perspectives on geometric representation and file formats. Toolpath generation. Capabilities, limitations, and design criteria for additive manufacturing processes. Digital representation of part geometries. Pre-processing, post-processing, and inspection of additively manufactured parts. Contemporary issues of data management for digital manufacturing.

b. prerequisites or co-requisites MFG 3723

c. indicate whether a required or elective course in the program: Elective

6. Specific goals for the course:

Upon completion of the course, students shall be able to:

- make critical choices between competing processes based on geometric, material, cost, and performance criteria
- prepare, repair, and modify various incoming file formats for 3D printing
- identify relative capabilities and limitations of common data formats in terms of fidelity, efficiency, security, flexibility, and interoperability
- interpret and generate basic G- and M- codes for toolpath creation

7. Explicitly indicate which of the student outcomes listed in Citerion 3 or any other outcomes are addressed by the course:

a. an ability to apply knowledge of mathematics, science and engineering

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

e. an ability to identify, formulate, and solve engineering problems

h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

j. a knowledge of contemporary issues

k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

8. Brief list of topics to be covered:

- additive manufacturing processes (capabilities, limitations)
- additive manufacturing materials
- geometry specification file formats: point cloud, wireframe, boundary representation (b-rep), Bezier, NURBS, Constructive Solid Geometry (CSG), STEP, Standard Tesselation Language (STL)
- File exchange formats (STEP, IGES, DXF, etc.)
- toolpath definition (G-code, M-Codes, proprietary variants)
- history of NC and CNC
- inspection of digitally manufactured components
- data management and security

Course Proposal – MFG 4821

What do you want to do? Change / **Add** / Delete / View

New Course Information

Course Prefix MFG

Course Number 4821

Course Title Manufacturing Capstone

Title Abbreviation

Course Description The application of manufacturing engineering techniques to real-world, open-ended questions. Problems will include elements of process and component analysis and design and will incorporate manufacturability, performance, and cost criteria. Design exercises will include data gathering, simulation, prototyping, and design verification. Students will be required to submit a final written report and accompanying technical documentation, including drawings. Grading is Traditional/PR.

Prerequisites Prereq or concurrent MFG 4823 and MFG 4861 and 96 credits s.h. of engineering degree credit.

Do you want variable credit? No

Course Semester Hours 3

Is this a semester lab? No

E-bulletin

Workload **Entry manually**

Choose from list

CIP Code

CIP Code Family: 14

CIP Code 14.3601

Course Type (press Ctrl to select more than one) **Lecture** / Seminar / Recitation / Lab

Justification and Syllabus: This will be the capstone course (as required by YSU policies) for the newly proposed Manufacturing Engineering program.

Justify Course Proposal :

*** Faculty :** Dr. Darrell Wallace, Dr. Brett Conner, Dr. Guha Manogharan

Syllabus (Attached)

Cross Listing

Cross List? No

Proposal and Memo

Will proposal affect another department? No

ABET SYLLABUS – MFG 4821

1. Course number and name: MFG 4821

2. Credits and contact hours: 3 s.h.

3. Instructor or course coordinator's name: Darrell Wallace

4. Textbook, title, author, and year: N/A

4.a. Other supplemental materials: course handouts

5. Specific course information

a. brief description of the content of the course (catalog description):

The application of manufacturing engineering techniques to real-world, open-ended questions. Problems will include elements of process and component analysis and design and will incorporate manufacturability, performance, and cost criteria. Design exercises will include data gathering, simulation, prototyping, and design verification. Students will be required to submit a final written report and accompanying technical documentation, including drawings. Grading is Traditional/PR.

b. prerequisites or co-requisites Prereq or concurrent MFG 4823 and MFG 4861 and 96 credits s.h. of engineering degree credit.

c. indicate whether a required or elective course in the program: Required

6. Specific goals for the course:

Students will demonstrate the ability to solve a real-world manufacturing problem including:

- listening to customer needs
- formulating a clear problem statement
- gathering available information and identifying additional data required to solve the problem
- gathering additional data or making documented, justifiable assumptions
- stating findings and recommended solution with accompanying data and engineering calculations
- presentation of technical findings in both written and oral presentation formats

7. Explicitly indicate which of the student outcomes listed in Citerion 3 or any other outcomes are addressed by the course:

a. an ability to apply knowledge of mathematics, science and engineering

b. an ability to design and conduct experiments, as well as to analyze and interpret data

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d. an ability to function on multidisciplinary teams

e. an ability to identify, formulate, and solve engineering problems

f. an understanding of professional and ethical responsibility

g. an ability to communicate effectively (3g1 orally, 3g2 written)

h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

i. a recognition of the need for, and an ability to engage in life-long learning

j. a knowledge of contemporary issues

k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

8. Brief list of topics to be covered:

- professional presentation and reporting expectations
- broad-based application of core concepts throughout the manufacturing engineering curriculum

Course Proposal – MFG 4823

What do you want to do? Change / **Add** / Delete / View

New Course Information

Course Prefix MFG

Course Number 4823

Course Title Manufacturing Processes II

Title Abbreviation

Course Description Broad discussion of manufacturing processes and underlying phenomena with analytical methods. Builds upon foundational understanding of processes established in MFG 3723 and focuses on the development of appropriate mathematical models to predict process parameters and effects on produced geometries and material properties.

Prerequisites ISEN 3723 and must be taken concurrently with MFG 4823/L

Do you want variable credit? No

Course Semester Hours 1

Is this a semester lab? Yes

E-bulletin

Workload **Entry manually**

Choose from list

CIP Code

CIP Code Family: 14

CIP Code 14.3601

Course Type (press Ctrl to select more than one) Lecture / Seminar / Recitation / **Lab**

Justification and Syllabus:

Justify Course Proposal : This course offers a rigorous treatment of the underlying physical phenomena in a wide range of manufacturing processes. This course goes into greater analytical depth than is present in the introductory course (MFG 3723) and requires a both a

basic understanding of manufacturing processes as well as a high degree of competency in calculus, physics, materials, and mechanical engineering fundamentals. This is a core course for the proposed program in Manufacturing Engineering.

*** Faculty :** Dr. Darrell Wallace, Dr. Brett Conner, Dr. Guha Manogharan

Syllabus (Attached)

Cross Listing

Cross List? No

Proposal and Memo

Will proposal affect another department? No

ABET SYLLABUS – MFG 4823

1. Course number and name: MFG 4823

2. Credits and contact hours: 3 s.h.

3. Instructor or course coordinator's name: Darrell Wallace

4. Textbook, title, author, and year: Mikell P. Groover, Fundamentals of Modern Manufacturing, 5th Ed., , Wiley, 2012

4.a. Other supplemental materials: course handouts

5. Specific course information:

a. brief description of the content of the course (catalog description):

Broad discussion of manufacturing processes and underlying phenomena with analytical methods. Builds upon foundational understanding of processes established in MFG 3723 and focuses on the development of appropriate mathematical models to predict process parameters and effects on produced geometries and material properties.

b. prerequisites or co-requisites ISEN 3723 and must be taken concurrently with MFG 4823/L

c. indicate whether a required or elective course in the program: Required

6. Specific goals for the course:

Students shall demonstrate the ability to:

- explain underlying physical phenomena to basic manufacturing processes
- develop analytical models that reasonably model processes and predict process outcomes
- utilize a range of analytical tools, including computer simulation, to model process behavior

7. Explicitly indicate which of the student outcomes listed in Citerion 3 or any other outcomes are addressed by the course:

a. an ability to apply knowledge of mathematics, science and engineering

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

e. an ability to identify, formulate, and solve engineering problems

k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

8. Brief list of topics to be covered:

- Physical models of common manufacturing processes (e.g. casting, forming, material removal, joining, welding, polymer processes)
- Simulation tools (FEA, Matlab)
- Limitations of analytical models

Course Proposal – MFG 4823/L

What do you want to do? Change / **Add** / Delete / View

New Course Information

Course Prefix MFG

Course Number 4823/L

Course Title Manufacturing Processes II Lab

Title Abbreviation

Course Description Laboratory to accompany Manufacturing Processes II. Experimental validation of manufacturing process analyses. Experimental design methods. Data collection, process automation, monitoring and control.

Prerequisites Must be taken concurrently MFG 4823

Do you want variable credit? No

Course Semester Hours 1

Is this a semester lab? Yes

E-bulletin

Workload **Entry manually**

Choose from list

CIP Code

CIP Code Family: 14

CIP Code 14.3601

Course Type (press Ctrl to select more than one) Lecture / Seminar / Recitation / **Lab**

Justification and Syllabus:

Justify Course Proposal :

*** Faculty :** Dr. Darrell Wallace, Dr. Brett Conner, Dr. Guha Manogharan

Syllabus (Attached)

Cross Listing

Cross List? No

Proposal and Memo

Will proposal affect another department? No

ABET SYLLABUS – MFG 4823/L

1. Course number and name: MFG 4823/L

2. Credits and contact hours: 1 s.h.

3. Instructor or course coordinator's name: Darrell Wallace

4. Textbook, title, author, and year: Mikell P. Groover, Fundamentals of Modern Manufacturing, 5th Ed., , Wiley, 2012

4.a. Other supplemental materials: course handouts

5. Specific course information

a. brief description of the content of the course (catalog description): Laboratory to accompany Manufacturing Processes II. Experimental validation of manufacturing process analyses. Experimental design methods. Data collection, process automation, monitoring and control.

b. prerequisites or co-requisites

c. indicate whether a required or elective course in the program: Required

6. Specific goals for the course:

Student shall demonstrate:

- ability to analytically predict the behavior of manufacturing processes
- ability to design experiments to verify analytical predictions
- ability to interpret experimental results and propose appropriate theories to explain discrepancies between analytical predictions and experimental findings
- ability to appropriately use measurement tools, sensors, instrumentation, and data acquisition tools to gather experimental data
- ability to use computational tools, including FEA and Matlab to perform data analysis

7. Explicitly indicate which of the student outcomes listed in Citerion 3 or any other outcomes are addressed by the course:

a. an ability to apply knowledge of mathematics, science and engineering

b. an ability to design and conduct experiments, as well as to analyze and interpret data

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

e. an ability to identify, formulate, and solve engineering problems

g. an ability to communicate effectively

k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

8. Brief list of topics to be covered:

- design of experiments
- metrology
- use of sensors and data acquisition
- experimental validation of process analyses for common processes (casting, forming, welding, polymer processes, etc.)

Course Proposal – MFG 4861

What do you want to do? Change / **Add** / Delete / View

New Course Information

Course Prefix MFG

Course Number 4861

Course Title Design for Manufacturability

Title Abbreviation

Course Description Introduction to the concepts of "Design for X" with particular emphasis on Design for Manufacturability and Assembly (DFMA). Implications of emerging additive manufacturing processes and associated Design for Additive Manufacturing (DFAM) principles will be discussed.

Prerequisites MFG 3723

Do you want variable credit? No

Course Semester Hours 3

Is this a semester lab? No

E-bulletin

Workload **Entry manually**

Choose from list

CIP Code

CIP Code Family: 14

CIP Code 14.3601

Course Type (press Ctrl to select more than one) **Lecture** / Seminar / Recitation / Lab

Justification and Syllabus:

Justify Course Proposal : This course introduces the concept that product design must be evaluated against a criterion of optimality. This concept is generalized at "Design for X" where X represents the optimization criterion. Most commonly, the most significant driver is cost.

Costs can be significantly reduced by designing products to utilize optimized manufacturing and assembly techniques. The application of these concepts has grown significantly more complex with the introduction of additive manufacturing processes. This course is an essential element of the new Manufacturing Engineering program curriculum.

*** Faculty :** Dr. Darrell Wallace, Dr. Brett Conner, Dr. Guha Manogharan

Syllabus (Attached)

Cross Listing

Cross List? No

Proposal and Memo

Will proposal affect another department? No

ABET SYLLABUS - MFG 4861

1. Course number and name:

2. Credits and contact hours: 3 s.h.

3. Instructor or course coordinator's name: Darrell Wallace

4. Textbook, title, author, and year: Product Design for Manufacture & Assembly, Peter Dewhurst, Winston Knight, Geoffrey Boothroyd, Marcel Dekker; 2nd edition, ISBN: 082470584X

4.a. Other supplemental materials: course handouts

5. Specific course information

a. brief description of the content of the course (catalog description): Introduction to the concepts of "Design for X" with particular emphasis on Design for Manufacturability and Assembly (DFMA). Implications of emerging additive manufacturing processes and associated Design for Additive Manufacturing (DFAM) principles will be discussed.

b. prerequisites or co-requisites MFG 3723

c. indicate whether a required or elective course in the program: Elective

6. Specific goals for the course:

Students shall demonstrate the ability to

- evaluate design objectives and choose appropriate strategy for design optimization
- perform structured design analysis by any of several methodologies
- apply DFMA principles to minimize manufacturing costs
- apply current best practices to assess designs for additive manufacturing

7. Explicitly indicate which of the student outcomes listed in Citerion 3 or any other outcomes are addressed by the course:

a. an ability to apply knowledge of mathematics, science and engineering

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

e. an ability to identify, formulate, and solve engineering problems

h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

j. a knowledge of contemporary issues

k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

8. Brief list of topics to be covered:

- Introduction to DFx
- The design process (objectives, theories, participants, plans)
- DFMA
- New Product Design (NPD)
- Functional requirements, design parameters, and process variables
- Stage gate review process
- Modular vs. integral design
- Design for assembly - assembly method selection
- Design efficiency
- Cost estimation
- Emerging design methodologies for AM processes
- Case studies

Course Proposal – MFG 5871

What do you want to do? Change / **Add** / Delete / View

New Course Information

Course Prefix MFG

Course Number 5871

Course Title Stress, Plasticity, and Deformation (with FEA) for Manufacturing

Title Abbreviation Plasticity

Course Description Investigation of the deformation characteristics of various manufacturing materials with emphasis on the plastic regime. Temperature and strain rate effects will be discussed. Applicability to the analysis of manufacturing deformation processes will be emphasized.

Prerequisites ISEN 3723

Do you want variable credit? No

Course Semester Hours 3

Is this a semester lab? No

E-bulletin

Workload **Entry manually**

Choose from list

CIP Code

CIP Code Family: 14

CIP Code 14.3601

Course Type (press Ctrl to select more than one) **Lecture** / Seminar / Recitation / Lab

Justification and Syllabus:

Justify Course Proposal : This course emphasizes material behavior in the plastic deformation regime. While understanding of plastic deformation is essential to many manufacturing processes, this regime is not covered extensively in other courses, as plastic

deformation is generally associated with component failure in most other engineering disciplines.

*** Faculty :** Dr. Darrell Wallace, Dr. Brett Conner, Dr. Guha Manogharan

Syllabus (Attached)

Cross Listing

Cross List? No

Proposal and Memo

Will proposal affect another department? No

ABET SYLLABUS – MFG 5871

1. Course number and name: MFG 5871

2. Credits and contact hours: 3 s.h.

3. Instructor or course coordinator's name: Darrell Wallace

4. Textbook, title, author, and year: The Mathematical Theory of Plasticity, R. Hill, 1998, Oxford University Press, ISBN 978-0198503675

4.a. Other supplemental materials: course handouts

5. Specific course information

a. brief description of the content of the course (catalog description): Theories of deformation, stress-strain relationships, and emphasis on mechanisms and models of plastic deformation. Simulation of elastic / plastic deformation using finite element computational methods.

b. prerequisites or co-requisites: MFG 3723

c. indicate whether a required or elective course in the program: Elective

6. Specific goals for the course:

Students shall demonstrate the ability to:

- characterize the stress-strain relationships of engineering materials using common simplified stress-strain models
- apply plasticity theory to predict stress-strain relationships of materials in the plastic deformation regime
- apply analytical methods to predict deformation in common manufacturing processes
- apply computational methods to predict and analyze complex deformation processes

7. Explicitly indicate which of the student outcomes listed in Citerion 3 or any other outcomes are addressed by the course:

a. an ability to apply knowledge of mathematics, science and engineering

b. an ability to design and conduct experiments, as well as to analyze and interpret data

c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

e. an ability to identify, formulate, and solve engineering problems

k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

8. Brief list of topics to be covered:

- ideal stress-strain relationships
- strain hardening
- Strain-rate sensitivity
- Yield criteria
- Simple loading: bending, torsion, tension, compression, and shear
- Complex Plastic-elastic problems
- Plane strain
- Introduction to finite element methods
- Boundary conditions
- Mesh generation
- Model validation

CAMPUS COMPLETION PLAN

OF

YOUNGSTOWN STATE UNIVERSITY

Approved by the YSU Board of Trustees

June 15, 2016

Executive Summary

Youngstown State University—an urban research university—emphasizes a creative, integrated approach to education, scholarship, and service. Enrollment at YSU rose from just under 11,800 in the fall of 1997 to a peak of just under 15,200 in the fall semester of 2010. Enrollments then drifted downward, in the fall semester of 2015 12,471 students were enrolled at YSU. Because of our open access policy, the student body of the University includes students with a wide variety of backgrounds and academic preparation. A substantial portion of the students belong to groups who, according to national statistics, have a lower probability of successfully completing a degree in a timely manner.

Overall, the University made great strides in achieving the goals established in the 2014 plan. Many of the original strategies have been completed, while several more have been deemed effective and will be continuing. Several new strategies have been developed and will be utilized to enhance our efforts over the next several years.

Youngstown State University provides significant value to the Youngstown-Warren metropolitan area, northeast Ohio, the state and the nation through research, scholarship, innovation, creative/scholarly activities, and service and workforce development. Our academic and workforce development priorities include those "in-demand" industries identified by JobsOhio which are poised to transform Ohio. In support of Workforce Development, YSU is committed to cultivating and sustaining appropriate bilateral and multilateral engagements amongst faculty, staff, students, and regional business, technological enterprises, industry, and non-profit organizations.

1. University Mission

The Youngstown State University mission statement reads as follows:

> Youngstown State University—an urban research university—emphasizes a creative, integrated approach to education, scholarship, and service. The University places students at its center; leads in the discovery, dissemination, and application of knowledge; advances civic, scientific, and technological development; and fosters collaboration to enrich the region and the world.
>
> The University:
>
> - Creates diverse educational experiences that develop ethical, intellectually curious students who are invested in their communities;
> - Provides access to a broad range of undergraduate programs;
> - Offers graduate programs in selected areas of excellence, including those that meet the needs of the region;
> - Supports economic development through applied learning and research;
> - Integrates teaching and learning, scholarship, and civic engagement;
> - Fosters understanding of diversity, sustainability, and global perspectives; and
> - Advances the intellectual and cultural life of the city, region, and world.

YSU, which became a state assisted institution in 1967, is currently organized into six academic colleges: the Williamson College of Business Administration; the Beeghly College of Education; the College of Creative Arts and Communication; the Bitonte College of Health and Human Services; the College of Liberal Arts and Social Sciences; and the College of Science, Technology, Engineering, and Mathematics. In addition, there is an overarching College of Graduate Studies that administers all graduate programs on campus, and an Honors College that provides enrichment experiences for students enrolled in our honors program. The University offers over 100 undergraduate majors, 35 master's programs, doctorates in educational leadership (Ed.D.) and physical therapy (DPT), and a PhD in Materials Science and Engineering. In the 2015-16 academic year YSU awarded 191 associates degrees, 1689 bachelor's degrees, 382 master's degrees, and 48 doctoral and educational specialist degrees, including the first every PhD in YSU history.

Enrollment at YSU rose from just under 11,800 in the fall of 1997 to a peak of just under 15,200 in the fall semester of 2010. Enrollments then drifted downward, in the fall semester of 2015 12,471 students were enrolled at YSU. Approximately 10 percent of the students are enrolled in graduate programs. About 65% percent of new students are residents of Mahoning, Trumbull, or Columbiana county, Mahoning county residents alone account for 38% of the freshmen class. Approximately 17 percent of new students come from outside Ohio, most are residents of

adjacent counties in western Pennsylvania. Women account for 54 percent of YSU students. Roughly 90 percent of YSU students live off campus.

2. Barriers to Persistence and Completion

According to the 2015-16 Undergraduate Bulletin: "Applicants who have graduated from a public or chartered high school or successfully completed the General Education Development (GED) test are eligible for admission to the University." Because of this open access policy, the student body of the University includes students with a wide variety of backgrounds and academic preparation. A substantial portion of the students belong to groups who, according to national statistics, have a lower probability of successfully completing a degree in a timely manner. The following table describes the proportion of students with those risk factors:

Persistence Risk Factors As Applied to YSU Students

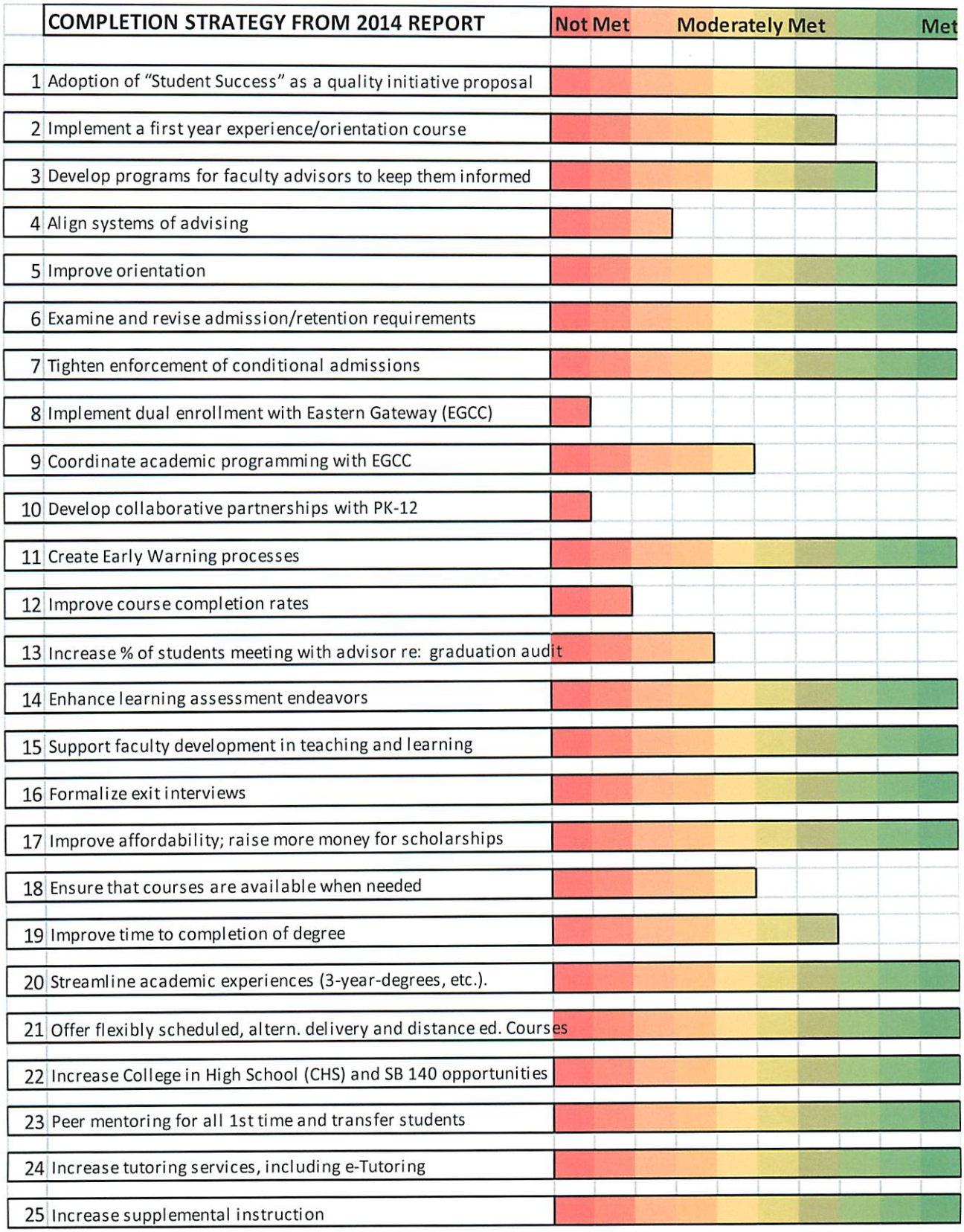
Lower socioeconomic class	87% of YSU students receive financial aid
Being academically underprepared	45% of entering YSU students take developmental classes
Having a disability	Approximately 407 (3.26%) students are registered with YSU Disability Services
Working more than halftime	Over 33% of YSU students work
Being a commuter student	90% of YSU students commute
Going to school part time	25% of YSU students attend part time
Being a first-generation college student	35% of YSU students are first-generation
Receive Pell Grant	42% of YSU students receive a Pell Grant
Coming from an underrepresented population	17% of YSU students are from underrepresented populations
Conditionally admitted	More than 10% of our new students are conditional admits (ACT<17 or HS gpa < 2.0)
Adult learners	26% of YSU students are older than 24

All of these risk factors represent continuing concerns as we endeavor to increase the educational attainment of the citizens of our region. Although overall educational attainment continues to lag behind state averages (this trend is largely due to the area's blue-collar history), we have seen positive increases in educational attainment over the past three years, according to the Chamber of Commerce.

To best serve its region, Youngstown State University has established programs and services that are data-driven and based on persistence and completion research and best practice.

3. Progress towards goals established in the initial completion plans

Overall, as can be seen by the chart below, the University made great strides in achieving the goals established in the 2014 plan. Many of the concepts established in the plan were good concepts and ones that will be utilized again in the 2016 plan with different measurable outcomes associated with them. A more detailed description of the progress on each of these completion goals is included following the summary chart.


COMPLETION STRATEGY FROM 2014 REPORT
Not Met
Moderately Met
Met
1 Adoption of "Student Success" as a quality initiative proposal
2 Implement a first year experience/orientation course
3 Develop programs for faculty advisors to keep them informed
4 Align systems of advising
5 Improve orientation
6 Examine and revise admission/retention requirements
7 Tighten enforcement of conditional admissions
8 Implement dual enrollment with Eastern Gateway (EGCC)
9 Coordinate academic programming with EGCC
10 Develop collaborative partnerships with PK-12
11 Create Early Warning processes
12 Improve course completion rates
13 Increase % of students meeting with advisor re: graduation audit
14 Enhance learning assessment endeavors
15 Support faculty development in teaching and learning
16 Formalize exit interviews
17 Improve affordability; raise more money for scholarships
18 Ensure that courses are available when needed
19 Improve time to completion of degree
20 Streamline academic experiences (3-year-degrees, etc.).
21 Offer flexibly scheduled, altern. delivery and distance ed. Courses
22 Increase College in High School (CHS) and SB 140 opportunities
23 Peer mentoring for all 1st time and transfer students
24 Increase tutoring services, including e-Tutoring
25 Increase supplemental instruction

Completion Strategy from 2014:

1. The University has adopted "Student Success" as a quality initiative proposal as part of the Higher Learning Commission's "Open Pathway" re-accreditation process. Accordingly, student success/completion has become the "tough challenge" that we aspire to.

Current Status:

Student Success Division has been formed and Institutional Emphasis on Student Success is becoming engrained in the culture.

Moving Forward

No further action is planned.

Completion Strategy from 2014:

2. Implement a first year experience/orientation course in each college. Most completion research indicates that an effective First year experience course enhances persistence. According to Noel-Levitz, more than 95% of universities nationally provide a first year experience course.

Current Status:

A 1st Year Course has been established in each college. Each course has also been streamlined to contain basic core curriculum designed to enhance student success

Moving Forward

A 1st year course will be required for all students starting in FA17. Specific population sections will also be explored (i.e. Conditional Admits).

Completion Strategy from 2014:

3. Develop programs for faculty advisors to keep them informed about changes in graduation requirements and explore a certification system for faculty advisors.

Current Status:

Each college has successfully created avenues to assist faculty advisors in staying current with graduation requirements.

Moving Forward

No further action is planned.

Completion Strategy from 2014:

4. Align systems of advising across the colleges. At YSU, advising strategies have varied from college to college. We are working to align advising as well as provide more information to students regarding degree completion and requirements. Our new E-Bulletin will provide the University community with clear and accurate information regarding all curriculum and program requirements.

Current Status:

E-Bulletin is in progress. This will be operational by Fall 2016. Aligning systems of advising is underway with the hiring of a Director of Career and Academic Advising, as well as an organizational restructure to create a ladder of progression for Academic Advisors.

Moving Forward

We will continue to look at policies and practices that better streamline what all advisors are doing. In 2016-17 we will implement the course management system of the e-bulletin. For Fall 2017 the new degree audit system will be in place.

Completion Strategy from 2014:

5. Improve orientation. We have added program dates to create smaller groups for a more personalized experience, reformatted sessions to facilitate active student learning and involved more faculty.

Current Status:

Orientation has been improved with the items outlined in the strategies.

Moving Forward

We will create learning outcomes for both parents and guests, providing greater assessment of our programs.

Completion Strategy from 2014:

6. Examine and revise admission/retention requirements. We revised our admissions standards to refuse some students whose preparation indicates little hope of success. We continue to review our standards to ensure that we are providing a supportive opportunity for all students who have a reasonable chance of being successful.

Current Status:

Since October 2013 when then-President Randy Dunn transitioned YSU from open admission to selective admission, the academic quality of the freshmen classes has increased substantially in three consecutive years. The quality gains have been made both by an increase at the top end of the applicant pool (through strategic use of scholarship dollars), and at the bottom end of the applicant pool (by limiting access for students with less than a 15 ACT). For the foreseeable future that will continue to be our approach, that is, modest adjustments upwards for what it takes to earn admission, and an annual increase in the very best academic students enrolling.

Moving Forward

No further action is planned.

Completion Strategy from 2014:

7. Tighten enforcement of conditional admissions. We implemented a new conditional admission policy which provides "best practices" structure and support for underprepared students.

Current Status:

The conditional admission policy was updated to include:

- Mandatory weekly visits with an academic coach
- Student must end the semester in good academic standing.

If the student failed to meet the requirements, the policy called for dismissal. Because of these consequences, students were much more diligent in attending coaching sessions and were therefore more successful. We have seen an increase in GPA and percentage of courses completed since the policy changes for this at-risk population.

Moving Forward

No further action is planned.

Completion Strategy from 2014:

8. Implement dual enrollment with Eastern Gateway Community College (EGCC). We continue to develop our relationship with EGCC, our partner in increasing the educational attainment of our citizens. Our goal is that our students will be able to avail themselves of the benefits of both institutions relatively seamlessly.

Current Status:

We have assembled a committee of faculty and staff from both YSU and EGCC to examine opportunities for better alignment. However, there has been little progress in this area at this time.

Moving Forward

The committee will continue to look at ways to better collaborate with EGCC.

Completion Strategy from 2014:

9. Coordinate academic programming with Eastern Gateway Community College. Each college is working with EGCC to provide clear, simple pathways for students to progress from EGCC to YSU.

Current Status:

Each college has established (where appropriate and feasible) 2+2 agreements for many of their programs.

Moving Forward

No further action is planned.

Completion Strategy from 2014:

10. Develop collaborative partnerships with PK-12. We plan to significantly enhance our relationships and dialogue with our educational partners in PK-12.

Current Status:

We continue to partner with local schools as appropriate.

Moving Forward

Continue at similar levels.

Completion Strategy from 2014:

11. Create Early Warning processes to improve student success. We implemented the Starfish Early warning system, which enables faculty and staff to flag students for kudos or for intervention. This program has shown good initial success.

Current Status:

Results have been good since the 2011 implementation of the Starfish Early-Alert program. Undergraduate course completion rates have increased from 78% in 2011 to 86.8% in 2015. We have also seen significant increases in course completions by first-year students. In 2011 the yield of credit hours earned vs. credit hours attempted for first- year students was 77.34% vs. 83% for the F14 cohort of first year students. Another positive indicator of the success of the early-alert program is the decrease in the number of students earning either an NAF or NC for a course from 4.41% for F11 cohort to .82% for the F14 cohort.

Moving Forward

We will be evaluating the Starfish system to see if it meets the current needs of the institution. We will also be looking at ways to increase the percentage of faculty that are utilizing the system.

Completion Strategy from 2014:

12. Improve course completion rates. The lowest common denominator to enhance completion is to improve the course completion rates for each course. Accordingly we have a group working now to find ways to improve course completion rates without detracting from academic rigor.

Current Status:

Minimal success was seen in advancing the course completion rate.

Moving Forward

We will be looking closer at the top 10 courses which have the highest D/F/W rate in order to better understand the characteristics of both the successful and unsuccessful students in order to create solutions that will positively impact these courses.

Completion Strategy from 2014:

13. To improve timely degree completion we will develop additional procedures to increase the percentage of students who meet with an advisor after they submit a graduation audit request.

Current Status:

YSU is in the process of making communication and contact time between advisor and student more convenient and more frequent. Through assessing the completion of the general education model for each graduating class beginning May 2015, we discovered that the process to clear a student for graduation is very non-systematic. Each college not only has their own style of senior sheet, but they have their own process of clearing the potential graduate prior to the term they intend to graduate.

A committee has convened to remedy this situation and we intend to implement a more systematic way of clearing students for graduation by the fall of 2016. In addition, other measures are being put into place to insure that the student's degree audit is accurate and complete by the time they graduate so it correctly reflects what the student has completed toward their intended degree.

Furthermore, the implementation of new degree audit software in the fiscal year 2016/2017 will allow the advisor to interact with their students in real time via the new U.Achieve system. It will give advisors greater control over the student's course choices and allow the student as well as the advisor to see where the student is in terms of making progress toward completing their four-year plan and toward successfully completing the courses in which they enroll each semester.

The new degree audit software will also give the university the ability to clear students electronically for graduation through a batch audit process.

Moving Forward

Implementation of the new degree audit software system.

Completion Strategy from 2014:

14. Enhance learning assessment endeavors. We are making numerous enhancements to the manner in which we measure learning.

Current Status:

Since 2014, "enhance learning assessment endeavors" as a support to completion has focused in two main areas. First, the university has strengthened the structures supporting student learning assessment. To strengthen structures, assessment has worked with programs to focus on closing the loop through use of assessment data to improve learning; partnered with general education to articulate the intersection of general education outcomes within the majors through curriculum mapping; and integrated program assessment into the newly developed program review processes.

Second, the university has fostered a vital campus community with faculty and staff engaged in meaningful student learning assessment activities. Building a positive culture is advanced by programs to build capacity in assessment and increase knowledge and skills of faculty and staff in this area. Two major programs supporting this work include the Best Practices in Student Learning Assessment Poster Competition, an opportunity for faculty and staff to share the good work being done to support student learning, and the Assessment Innovation Mini-Grant Program, small grants provided to seed sustainable student learning assessment activities.

Moving Forward

Moving forward, assessment endeavors can be advanced through implementation of long-term assessment cycle planning, currently in the planning phase as a part of program review implementation. Assessment would also benefit from expanding professional development and consultation, to advance practitioner knowledge and skills. Finally, expanding programs to foster assessment innovation, perhaps with a focus on currently under-represented groups (such as part-time faculty) could further integrate assessment activities and benefits.

Completion Strategy from 2014:

15. Support faculty development in teaching and learning. We've implemented a comprehensive program of internal faculty professional development designed to help faculty be more effective.

Current Status:

The faculty development program is more robust than ever. Key activities include: (1) Orientation programs for new full and part time faculty and department chairs, (2) A "new faculty mentorship" program, (3) Six active faculty learning communities (another was just added on distance education), (4) The opportunity for individual faculty consultation on teaching strategies, and (5) two series of workshops, one for new faculty and one for all faculty (this included a two day seminar in January). The budget has been increased for 2015-2016, so more resources have been committed to faculty development.

Moving Forward

Next year, we will continue these activities, and plan to add even more, especially with regard to online development opportunities.

Completion Strategy from 2014:

16. Formalize exit interviews. We contact all students who are leaving the University in order to provide them with any assistance that might be needed in order to help them continue their education rather than leave, as well as receive any feedback we can regarding the issues that caused them to leave.

Current Status:

The online exit interview was established in Spring 2015 and the process has worked well. Students must complete the interview before they can completely withdraw. The survey is short and concise. Our referral process allows the Student One Stop to reach out to these students and provide personal assistance they otherwise would not have received. The referral process also provides the related departments the opportunity to also reach out to assist the student. Notable results from the surveys:

Primary reasons for withdrawal were: family/relationship concerns, work schedule changes, financial concerns, and health reasons. Only a very small number noted Instruction/advisement, lack of social connections, or lack of campus services as reasons for withdrawal. In addition, 85% of the respondents indicated that there was nothing specifically the university could have done to help them stay at YSU.

Moving Forward

We will continue to utilize the results of the study in the allocation of retention resources.

Completion Strategy from 2014:

17. Improve affordability; raise more money for scholarships.

Current Status:

Significant changes have been made over the past 18 months in the way that merit based scholarship awards have been distributed. A reduction in the number of "full ride" Cochran Scholarships, and the redistribution of those savings, has allowed us to provide significant awards ($1,000-3,000 annually in addition to whatever they were already receiving) to all students accepted to the Honors College. The creation of housing awards (primarily for those outside of our local region) for Honors College admits ($1,000-3,000), Living Learning Communities in each college ($1,000-3,000) and a new Trailblazer Award (first generation, low income, ethnic minority or Appalachian county resident) in the amount of $2,000 have all added to the affordability of a YSU education for many, many more students. In addition to all of the above, YSU has frozen both tuition (by state mandate) and housing (by choice) for the following year. This will continue to be our strategy in the coming 2-3 years.

YSU Foundation

Gifts, Payments and Pledges/Planned Giving to Scholarships and Endowments

	FY14		FY15		FY16 to Mar. 18, 2016 (8.5 Mos.)	
	Number of Gifts	Amount	Number of Gifts	Amount	Number of Gifts	Amount
Cash Gifts	1,763	$2,677,692	1,975	$3,236,696	1,376	$2,422,621
Payments	921	$560,519	649	$1,415,299	359	$2,127,099
Total Cash/Payments	2,684	3,238,211	2,624	4,651,995	1,735	4,549,720
Pledges/Planned Giving	74	$2,940,410	65	$3,471,081	85	$5,022,204

Moving Forward

No further action is planned.

Completion Strategy from 2014:

18. Ensure that courses are available when needed.

Current Status:

The creation and updating of curriculum sheets and 4 year "road maps" has enabled students to better track their degree completion. In turn, the University is better able to track the need for specific courses by students.

Moving Forward

The new e-bulletin software provides a mechanism for updating, maintaining and distributing information at the programmatic level. Further work is needed in this area.

Completion Strategy from 2014:

19. Improve time to completion of degree.

Current Status:

Since 2014, we have increased the number of transfer articulation agreements with other institutions. As of February 2014, we had approximately 12 active agreements with other schools in Ohio and Western Pennsylvania. Today, we have 52 active agreements and each semester add additional agreements.

In addition to articulations, YSU is one of the leading institutions in the Northeast region for Prior Learning Assessment and Military Credit initiatives. In fact, YSU serves as a case study for Prior Learning Assessment because we have made significant progress in this initiative in one year's time.

YSU also participates in the American Council on Education Alternative Credit Project which allows non-traditional students to transfer credits from non-traditional sources to YSU to get a jump on their college careers.

Moving Forward

No further action is planned.

Completion Strategy from 2014:

20. Streamline academic experiences (3-year-degrees, etc.). We continue to identify and publicize pathways for students to accelerate their degree completion.

Current Status:

We have worked with each of our academic programs to identify the quickest routes to degrees. Furthermore, we have continued to grow the College Credit Plus program, thus recruiting more students who come to us with transferrable hours.

Moving Forward

No further action is planned.

Completion Strategy from 2014:

21. Offer flexibly scheduled, alternative delivery and distance education courses and programs.

Current Status:

We have a successful distance education program and continue to assess the needs of students.

Moving Forward

No further action is planned.

Completion Strategy from 2014:

22. Increase College in High School (CHS) and SB 140 opportunities for students. New research indicates that students who receive college credit during high school are much more likely to persist to graduation. We are working to improve our SB 140, CHS and Early College programs.

Current Status:

Change and growth have been a constant in YSU's dual enrollment programs. The SB 140 program came together with the high school based "College in High School" dual enrollment, resulting in a 100% increase in on-campus enrollment. Growth was boosted when the Ohio Department of Higher Education enacted the College Credit Plus (CCP) legislation expanding access to students by standardizing admission criteria and making the program no-cost to students. YSU's CCP program continued to increase the numbers of districts served and the menu of courses being offered in the high school. YSU faculty provide robust professional development opportunities in content specific workshops for the high school based faculty. YSU began an on-campus orientation and advisement program, as well as an interactive text-messaging platform that enables "just in time" assistance to students with questions or in need of help. Followers of the CCP program's social media increased from a handful to over 800.

2013-14 to 2015-16

Program Growth

- Students enrolled: 770 to 1,404 (82% increase)
- Credit hours enrolled: 5005 to @ 10,000 (100% increase)
- District partnerships: 44 to 65 (47% increase)
- Courses offered: 18 to 23 (28% increase)

Student Success

- Average ACT Composite 25
- Course completion rate (D or higher): 99 %

Professional Development

YSU faculty offer two professional development workshops in each subject area to CCP instructors each year (total of 69 hours of PD/year).

Moving Forward

We will continue to support the students in this program and attempt to recruit them to be full time YSU students upon graduation.