To:	Academic Program Review Council
From:	Ferris State University
CC:	[Recipient names]
Date:	9/4/2013
Re:	CAD Drafting and Tool Design Technology Program Update to address program concerns from APR recommendations

The CAD Drafting and Tool Design program has made several changes within the program to address the concerns of the APRC. The first item that needs to be addressed is that the program has been at and actually over capacity for the past four years given the current resources of two faculty members and a maximum lab capacity of 22 students for the first year students.

The current students and graduates have easily found employment both for summer experiences and full time employment. At the time of the last APR the manufacturing arena had taken a downturn and that had a very small impact on our graduates. Our students are continually being sought after for fulltime employment and by programs that our students transfer into for a four year degree.

We have also worked very hard to advocate with our Dean's office that our computers are our lab equipment and are more than essential to the program. We were fortunate to get one of our two labs upgraded last year to have computer equipment that works well with our software programs. We would still like to see the second lab receive a similar upgrade and a process in place for routine computer replacement.

Another item of importance to add is that our students as of the past two years do recommend our program to others as can be observed by our internal transfers into the program. A significant reason why some of the four year programs that formerly received our students have been affected is that we cannot accept any more into the program given the current constraints and we also need better marketing support to high school programs to share program information.

The CDTD program is really a true 2+2 program that provides our students with a variety of options to enter the field where they find their niche. Being that everything starts with design our students throughout their two years in the program gain exposure to a variety of different careers centered around the manufacturing of products. The vast majority of our students transfer into Product Design Engineering Technology, Manufacturing Engineering Technology, and Plastics Engineering Technology. We also have students enter into the Mechanical Engineering Technology program and Career Technical Education program in the College of Education and Human Services. The faculty in the program has worked with each of these departments to develop transfer plans so that there is a seamless entry into the programs. CDTD is perfectly aligned with Plastics Engineering Technology, Manufacturing Engineering Technology, Product Design Engineering Technology, Mechanical Engineering Technology, and Career and Technical Education. Each of the programs that we feed into within the CET actively recruit our graduate as can be observed by the number of recent transfers into the four year degrees. Each of the program faculty from these programs has shared their satisfaction of the student that they receive and how that student gets unique internships and job offers due to their combination of design with the manufacturing degree.

In addition to the above changes that have been made the program conducted a DACUM analysis last year to determine if the program was aligning with the industry needs. The analysis showed that the CDTD program was meeting the needs for entry level tool designers. The analysis also showed that there is room for further development of degree offerings to add on to the current four year degree offerings. There continues to be a significant shortage of graduates with the experience that the industry requires and we are one of the only schools that provides the level of education and experience that is currently needed.

If the committee has any questions please do not hesitate to contact me and I would be happy to meet to discuss the CDTD program and what the two faculty members have been able to do to advance the program and the Ferris mission.

Sincerely,

Dan Wanink

DACUM

FOR

Ferris State University
College of Engineering Technology
School of CEEMS
Big Rapids, MI 49307

AAS CAD Drafting & Tool Design Technology

Prepared by:

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College of Education & Human Services
School of Education
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Thursday, March 21, 2013

Ferris State University
CAD Drafting and Tool Design Technology
Proposed New Program Name: Design and Development Technology

	Core
A	Solid Modeling
B	Engineering Drawings
C	Basic Machining
D	Introduction to die design
E	Introduction to mold design
F	Introduction to machine design
G	Introduction to GD&T and tolerance analysis
H	Introduction to material science
I	Introduction to jig and fixtures design
J	Business Communication
	Elective--Tool Designer
K	Advanced die design
L	Advanced machine design
M	Advanced mold design
	Elective--Product Designer
N	Design for Manufacturing
O	Advanced 3D modeling

Panel was asked to identify tasks they want graduates to be able to perform

Core Required

A			**Solid Modeling**
	1		Analyze CAD drawing data
	2		Create 3D models
	3		Locate parts in space with correct orientation and datum scheme
	4		Effectively and efficiently model the part with appropriate features (no dirty modeling)
	5		Create a parametric model
	6		Create functional assemblies
		a	dynamic constraints
		b	appropriate assembly sequence
	7		Integrate third party content into models (downloadable)
	8		Analyze model for interferences
	9		Export to various file formats, such as
		a	step
		b	iges
		c	prt
		d	parasolid
		e	stl
		f	catpart
		g	edrawing
		h	3D
		i	pdf
B			**Engineering Drawings**
	10		Apply general drafting standards for preparation and presentation including selecting appropriate paper size, etc.
	11		Create orthographic projections, such as
		a	section views
		b	detail views
		c	auxiliary views
		d	brokwn views
	12		Apply all dimensioning styles and types, such as
		a	ordinates
		b	functional
		c	tolerances
	13		Edit CAD drawing/model (apply and track engineering changes)
	14		Create assembly drawings, such as
		a	exploded views
		b	ballooning
		c	BOM
	15		Draw threads and fasteners
	16		Measure and apply measurements to drawings
	17		Interpret and apply weld symbols
	18		Call out standard notes and surface finishes, as appropriate
	19		Apply standardized filing structure
	20		Export to various file formats, such as
		a	dwg
		b	dxf
		c	iges
		d	pdg

Ferris State University
CAD Drafting and Tool Design Technology
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Panel was asked to identify tasks they want graduates to be able to perform

C			**Basic Machining**
	21		Comply with safety procedures and processes
	22		Identify different machining equipment
	23		Operate lathe
	24		Operate vertical mill
	25		Operate grinders, such as
		a	surface
		b	pedestal
		c	air
	26		Operate precision measuring equipment including
		a	micrometers
		b	calipers
		c	height gages
	27		Use appropriate vocabulary for machining
	28		Operate common hand tools, such as
		a	hammers
		b	werenches
		c	vise
		d	files
	29		Perform tapping and threading operations
	30		Identify function and operation of various machining processes such as
		a	EDM
		b	CNC
	31		Calculate feeds and speeds
	32		Draw and machine a part
D			**Introduction to die design**
	33		Describe components of a die and types of dies, such as
		a	stationary
		b	progressive
		c	transfer
		d	deep draw
	34		Describe operation of die
	35		Model a stationary die
	36		Model a progressive die with CAM
	37		Perform fundamental tool design calculations, such as
		a	press tonnage
		b	tolerance between die and punch
		c	bend radius
E			**Introduction to mold design**
	38		Describe components of a mold including various types of molds, such as
		a	mud
		b	compression
		c	injection
		d	blow
		e	rotational
	39		Describe operation of a mold
	40		Model a mold with undercut tooling actions
	41		Perform fundamental tool design calculations, such as
		a	press tonnage
		b	plastic shrinkage
		c	cooling sizing
		d	gate

__Ferris State University__
__CAD Drafting and Tool Design Technology__
__Proposed New Program Name: Design and Development Technology__

__Panel was asked to identify tasks they want graduates to be able to perform__

F			**Introduction to machine design**
	42		Demonstrate skills in problem solving, diagnostics, and troubleshooting
	43		Identify mechanical drives and mechanisms
	44		Identify function of pneumatic and hydraulic slide/cylinders
	45		Identify function, components and operation of basic machines in manufacturing environment, such as
		a	dial machines
		b	assembly lines
		c	stand alone cells
		d	Robotic cells
	46		Identify advantages and disadvantages and common applications of rotational drive systems, such as
		a	gear
		b	belt
		c	pulley
	47		Identify advantages and disadvantages and common applications of linear drive systems, such as
		a	pneumatic actuators
		b	servo
		c	ball screw
		d	hydraulic
	48		Identify types and common applications of control systems, such as
		a	switches
		b	pneumatic/hydraulic valves
		c	PLC's
		d	HMI's
		e	light curtains
		f	palm buttons
		g	safety switches
		h	opto touch senses
		i	safety gates
	49		Identify types of basic machine frames/structure and designs, such as
		a	overhead
		b	weldments
		c	C-frames
		d	cantilever beams
	50		Design a simple machine, such as
		a	"pick and place"
		b	gib slide
		c	robotic end effector
	51		Integrate ergonomic and safety principles into design
	52		Design a sheet metal project
G			**Introduction to GD&T and tolerance analysis**
	53		Isolate six degrees of freedom using the datum system
	54		Identify 14 geometric characteristics and 15 modifying symbols
	55		Apply specific geometric characteristics correctly for a specific application
	56		Identify and interpret common GD&T symbols
	57		Establish datum scheme in all primary, secondary, and third schemes
	58		Create a feature control frame
	59		Use appropriate terminology for GD&T
	60		Identify tolerances zones and tolerance modifiers
	61		Differentiate between ISO and ASME Y14.5 standards
	62		Apply 14 symbols of GD&T in multiple applications
	63		Perform tolerance stackups between multiple components, such as
		a	root sum squared
		b	max/min
	64		Design a fixture or take fixture designed earlier in program to add GD&T

Panel was asked to identify tasks they want graduates to be able to perform

H			**Introduction to material science**
	65		Identify material properties for plastics, metals, and composites
	66		Identify common manufacturing processes for each type of material
	67		Identify test methods for specific materials
	68		Perform specific tests on different materials, such as
		a	heat treating
		b	tensile strength
		c	hardness
		d	ferrous/non-ferrous
	69		Identify common surface treatments and coatings for common materials
	70		Identify common corrosion resistance materials and applications
	71		Interpret stress strain curve
	72		Select appropriate materials based on application
I			**Introduction to jig and fixtures design**
	73		Differentiate between jigs and fixtures
	74		Identify methods and components of clamping mechanisms, locating features, etc.
	75		Design a simple jig
	76		Design a simple part-holding fixture
	77		Apply GD&T to the design
	78		Integrate ergonomic and safety principles into design
J			**Business Communication**
	79		Set up or participate in teleconference tools such as online meeting tools
	80		Sketch a design
	81		Make a professional presentation of a design including project plan and cycle times
	82		Compose professional communications with clients and colleagues, such as
		a	emails
		b	letters
		c	meetings
		d	webinars
	83		Complete engineering changes
	84		Develop a project plan (using computerized project management tools)
	85		Compose a corrective action for a problem with a design
	86		Complete a job interview with a group of professionals
	87		Gather design criteria/materials to create a design brief or engineering proposal, such as
		a	design specifications
		b	clients
		c	test specifications
		d	target costing
		e	project timeline
	88		Demonstrate and apply manufacturing process management techniques, such as
		a	lean
		b	Kaizen
		c	continuous improvement
		d	5S
		e	waste (muda)
		f	VSM
		g	Kanban
		h	standard work
	89		Describe cultural differences in major manufacturing areas of the world (European, Asia, India)
	90		Apply principles of 'world class' operations (industry quality standard operation)

Panel was asked to identify tasks they want graduates to be able to perform

Electives--Tool Designer

K			**Advanced die design**
	91		Design multi-stage, progressive dies
	92		Perform advances calculations, including forces, bend radius, tonnage, material thickness, etc.
	93		Incorporate various die/press components including stock feeders, part strippers, part holders, etc.
	94		Handle scrap in the design and calculate scrap costs
	95		Identify advanced die shop setup to include advantaged material handling, SMED, etc.
	96		Design safety measures into a design, such as
		a	guarding
		b	hand presses
		c	switches
L			**Advanced machine design**
	97		Design vacuum holding device
	98		Calculate pneumatic/hydraulic cylinder size for load
	99		Size a gear or belt drive for a given load
	100		Incorporate specific sensing devices into a design and types of PNP and NPN sensors, such as
		a	prox
		b	limit
		c	hall effect
		d	vacuum
		e	photoelectric
		f	pressure transducers
		g	thermocouples
		h	load cells
	101		Incorporate piping and wire routings into a design
	102		Identify appropriate clearances in a design, such as
		a	human reach
		b	swing motion
		c	tool access
	103		Identify pneumatic/hydraulic controls (especially types of valves, etc.)
	104		Incorporate robots into design (types of six axis, five axis, etc.)
	105		Complete a robot motion study using the 3D software or a simulator
	106		Design a more sophisticated station or machine (e.g., dial machine with two stations, etc.) including maintenance components
	107		Perform a risk analysis

Panel was asked to identify tasks they want graduates to be able to perform

M			Advanced mold design
	108		Identify mold components and actions (e.g., hydraulic, basic concept of how it works)
	109		Assemble and disassemble a mold
	110		Design a more complex mold, such as
		a	complex ejector slides
		b	different types and location of gates
		c	cooling
		d	CAE course
		e	structural ribs
		f	flow of plastics
		g	multi-cavity
		h	ejection practices
		i	venting
		j	insert brass inserts
		k	over molding
	111		Incorporate cooling and manual actions into mold design
	112		Design a complex parting line runout
	113		Design a manifold injection system
	114		Design advanced steel type and plastic type mold features such as mold inserts (for cooling, grilling, etc.)
	115		Calculate cycle time including
		a	pack
		b	hold
		c	cooling

Panel was asked to identify tasks they want graduates to be able to perform

Electives--Product Designer

N			**Design for Manufacturing**
	116		Identify manufacturing processes, such as
		a	costs
		b	number of steps
		c	tooling/manufacturing accessibility
		d	assembly
	117		Apply tolerancing
	118		Design for assembly
	119		Design ergonomics into a design
	120		Design poke-a-yoke into the design
	121		Design locating schemes between mating parts
	122		Analyze interactions of dissimilar materials (e.g., corrosion hazard, friction, etc.)
	123		Streamline components to optimize manufacturing
	124		Use a physical prototype to test design
	125		From a concept sketch or design, design a product
	126		Design for environmental issues and concerns
	127		Analyze for costs, shapes, annual volume, etc.
	128		Design for total product lifecycle (including disassembly for rework and recycling)
	129		Design a consumer product and analyze results
	130		Select appropriate materials for design/process
O			**Advanced 3D modeling**
	131		Design for advanced assemblies (including motion studies, dynamic constraints, etc.)
	132		Create complex surfaces (interpret form from a drawing or sketch)
	133		Create table-driven assemblies or parts
	134		Create a rendering of a product that includes
		a	lighting
		b	texture
		c	surface finish
		d	color
		e	in an appropriate environment
	135		Design more complex parts that incorporate
		a	loft
		b	sweeps
		c	intersect
		d	ribbing
		e	pro-E piping
		f	thin features
		g	helical sweeps (helically cut a thread using correct pitch and major/minor diameters)
		h	springs
	136		Design a cam and gears for more complex motion

Ferris State University
CAD Drafting and Tool Design Technology
Proposed New Program Name: Design and Development Technology

	Core	Total Credits	Lecture Hours	Lab Hours	Lecture Credits (based on 15 clock hours = 1 credit)	Lab Credits (based on 30 clock hours = 1 credit)
A	Solid Modeling	6	30	120	2	4
B	Engineering Drawings	3	15	60	1	2
C	Basic Machining	4	15	90	1	3
D	Introduction to die design	3	30	30	2	1
E	Introduction to mold design	3	30	30	2	1
F	Introduction to machine design	3	30	30	2	1
G	Introduction to GD&T and tolerance analysis	3	45	0	3	0
H	Introduction to material science	4	30	60	2	2
I	Introduction to jig and fixtures design	3	30	30	2	1
J	Business Communication	3	45	0	3	0
	Elective--Tool Designer	**Total Credits**	**Lecture Hours**	**Lab Hours**	**Lecture Credits**	**Lab Credits**
K	Advanced die design	4	15	90	1	3
L	Advanced machine design	4	15	90	1	3
M	Advanced mold design	4	15	90	1	3
	Elective--Product Designer	**Total Credits**	**Lecture Hours**	**Lab Hours**	**Lecture Credits**	**Lab Credits**
N	Design for Manufacturing	4	60		4	0
O	Advanced 3D modeling	6	30	120	2	4
	Core Total	**35**	**300**	**450**	**20**	**15**
	Tool Designer Electives Totals	**12**	**45**	**270**	**3**	**9**
	Product Designer Electives Totals	**10**	**90**	**120**	**6**	**4**

JOB ANALYSIS PERFORMED FOR:	**Ferris State University** College of Engineering Technology CEEMS CAD Drafting & Tool Design Technology
DEGREE PROPRAM ANALYZED:	***AAS CAD Drafting & Tool Design Technology***
PERFORMED BY:	Dr. Katherine (Kitty) Manley, Professor Ferris State University School of Education 416A Bishop Hall Big Rapids, MI 49307 231-591-2727 e-mail: manleyk@ferris.edu

REVIEW PANEL:

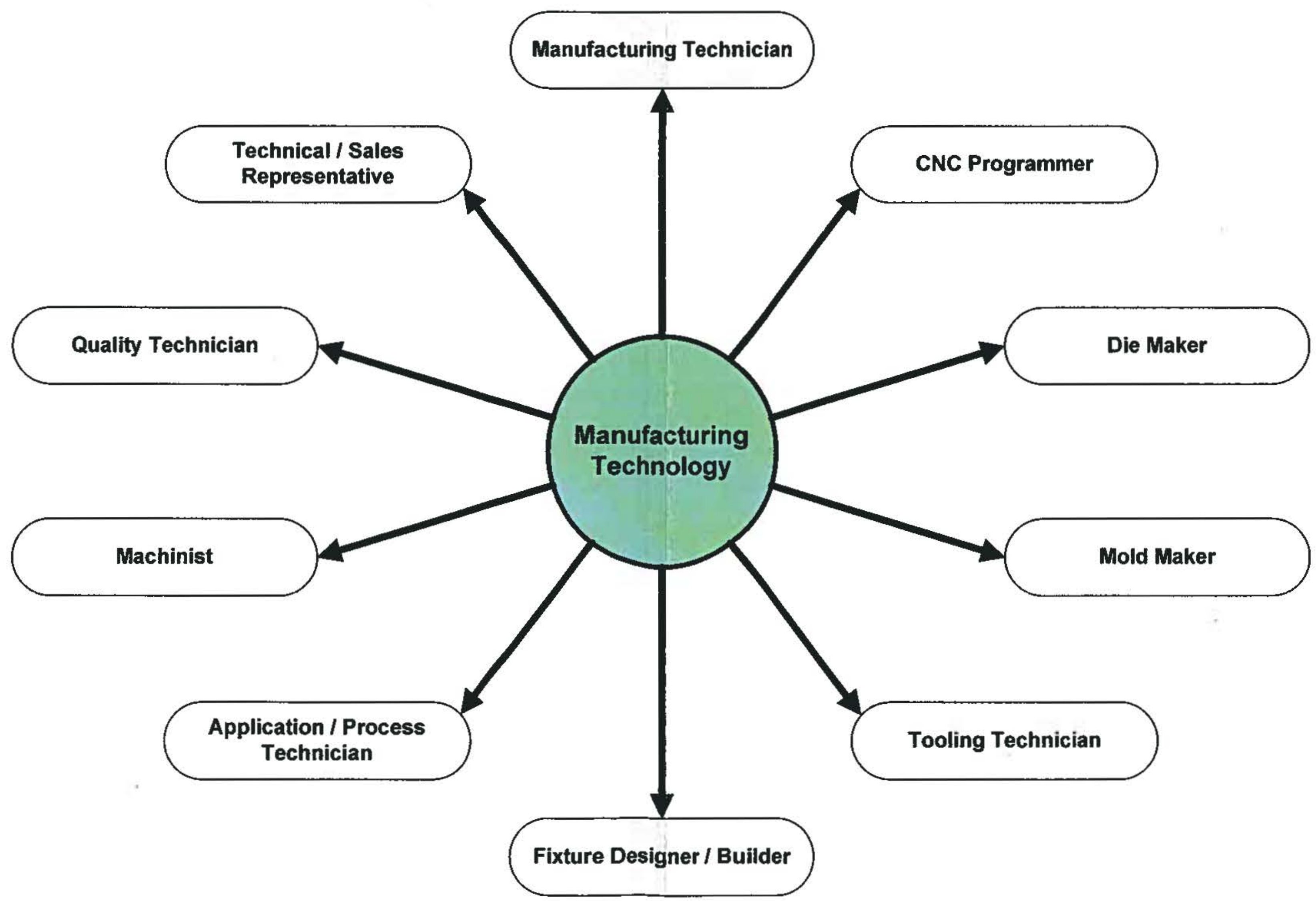
Sikonia, Bob	Extreme Tool & Engineering, Inc.
Schulte, Robert	Hi-Tech Mold
Tomlinson, Mark	SME
Lavender, Erin	B & P Manufacturing
Masko, Ray	Superior Concepts
Goodenough, Dave	Edgewater Automation
Kyle Magneson	
Perry Betterley	Stryker Global Quality & Operations Kalamazoo Campus Operations

REVIEW DATES: 3/21/2013

Ferris State University's

Manufacturing Technology Associates Degree

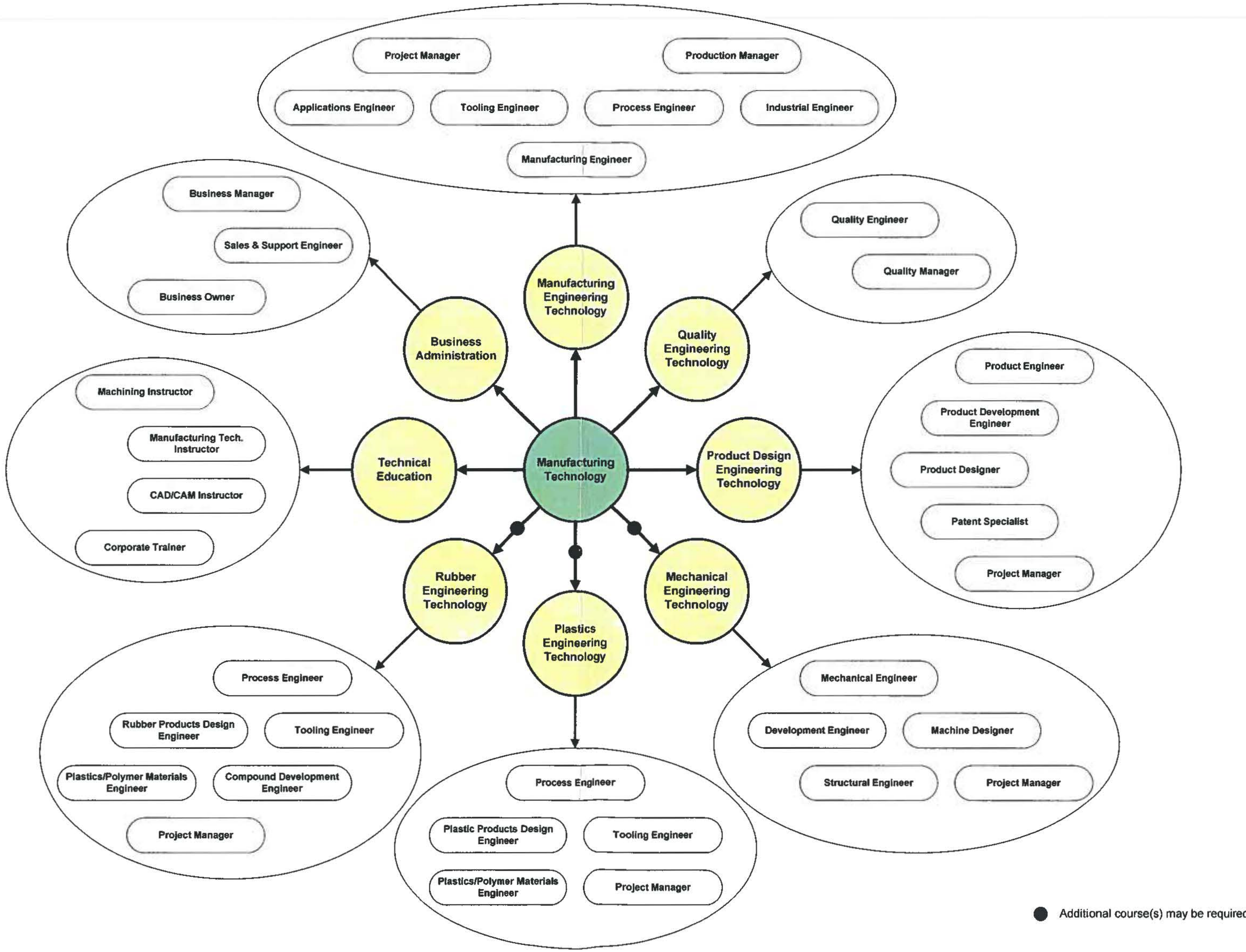
Related Occupations



Ferris State University's

Manufacturing Technology Associates Degree

Continuing Education Options & Related Occupations



MEMORANDUM

DATE: 17 November 2009
TO: Academic Senate
FROM: Academic Program Review Council
SUBJECT: Recommendations for A.A.S. in **CAD Drafting and Tool Design**
CC: Todd Rose, Rich Goosen, Tom Oldfield, Donald Flickinger, Roberta Teahen, Fritz Erickson

I. IDENTITY OF PROGRAM:

A.A.S. in CAD Drafting and Tool Design

II. RECOMMENDATION OF ACADEMIC PROGRAM REVIEW COUNCIL:

Continue the Program with Redirection: The program's status with respect to the categories in Section 5 of the report merits continuation. However, the program needs a curricular redirection, and the faculty and administration of the program will be asked to report as to their progress in carrying out this redirection.

III. RATING BASED ON CRITERIA:

- **Relationship to FSU Mission:** The CDTD program aligns to the FSU mission by providing a career education and opportunities for lifelong learning for FSU students.
- **Program Visibility and Distinctiveness:** The program is unique in its location in a university setting in Michigan, as well as its combining of CAD drafting and tool design in a single program. Students enroll in it to enter industry as professionals in CDTD.
- **Program Value:** The programs provide graduates for CAD drafting and tool design careers and students for four-year programs.
- **Program Enrollment:** In Fall 2008, 48 students were majoring in CDTD.
- **Characteristics, Quality, and Employability of Students:** Graduates of the program find employment in Michigan and throughout the United States.
- **Quality of Curriculum and Instruction:** Curriculum and instruction are of high quality.
- **Composition and Quality of Faculty:** The CDTD faculty are well qualified.

IV. APRC NOTES THE FOLLOWING STRENGTHS OF THE PROGRAM:

- The program combines CAD drafting and tool design into one program.
- The program has an experienced advisory board.
- Graduates receive good starting salaries.
- Faculty are experienced professionals.

V. APRC NOTES THE FOLLOWING CONCERNS REGARDING THE PROGRAM:

- Enrollment has declined to roughly half the level of four years ago, partially due to community college competition, and partially due to changes in the industries that formerly employed the program's students.
- Students have concerns regarding advisement and laboratory equipment, and many of those surveyed would not recommend the program to others.

- The enrollment in four-year programs that formerly received students from CDTD has been affected.

VI. THE PROGRAM MUST SUBMIT A REPORT, DUE 7OCTOBER 2011, THAT FOCUSES ON THE FOLLOWING ISSUES:

- The program faculty and administration need to develop a plan to re-direct the program so that it becomes the first two-years of a four-year degree program with options corresponding to the Ferris degree programs its graduates now enroll in.