M O N T A N A B O A R D O F R E G E N T S

LEVEL II REQUEST FORM

Item No.:	**136-2705-R0907**	**Date of Meeting:**	**September 19-21, 2007**
Institution:	**Montana State University Billings**		
Program Title:	**Associate of Applied Science Power Plant Technology**		

Level II proposals require approval by the Board of Regents.

Level II action requested (check all that apply): Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

- ☐ 1. Change names of degrees (e.g. from B.A. to B.F.A.)
- ☐ 2. Implement a new minor or certificate where there is no major or no option in a major;
- ☒ 3. Establish new degrees and add majors to existing degrees;
- ☐ 4. Expand/extend approved mission; and
- ☐ 5. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.

Specify Request:

Montana State University-Billings College of Technology seeks permission to offer a two-year Associate of Applied Science Power Plant Technology Program.

LEVEL II BOARD OF REGENTS ITEMS
Montana State University-Billings College of Technology
Associate of Applied Science Power Plant Technology

Curriculum Proposal

1. Overview

The field of power plant technology offers high-wage and interesting careers for technicians. Job demand is strong in the power plant technology field. Employers often hire graduates for work in other operations besides power plants, taking advantage of their theoretical and practical training in mechanical and electrical technology. Besides power plants, job settings include research and development facilities, industrial process operations, or the sales and service fields.

Montana State University Billings College of Technology (MSU-B COT) Power Plant Technology program will add a technical, two-year associate of applied science degree to existing programs in response to the need to develop educational pathways for Montana's high-demand careers in energy. This program will provide the opportunity for individuals with no training or for incumbent workers to obtain highly technical education and skills training. Upon successful completion of this program, a student will have earned an Associate of Applied Science degree in Power Plant Technology.

2. Need

a. To what specific need is the institution responding in developing the proposed program?

Thousands of people are employed nationwide in this occupation; however, there are a limited number of training programs available nationally. PPL-Montana is projecting nearly 48% of their technical employees retiring within the next seven years. This will result in 280 retirements from PPL alone. In addition, a new company has moved into Billings, TIMEC which will seek to employ 300 new new mechanics, INT Tech,Millrights, and process technicians which will make the competition for a new workforce even keener. Another factor contributing to the shortage involves the addition of a new Power Plant was recently implemented in Hardin with a second planned for Great Falls. (Source: Larry MCGinley, Director of Human Resources, PPL Montana).

Montana has several power generating facilities but no specific post-secondary training programs in Power Plant Technology. A survey of post-secondary Power Plant Technology programs revealed the nearest accredited program is in Bismarck, North Dakota with other accredited programs available nationally in Alabama, California, Georgia, Kentucky, and Texas. Most education and training for Montana's power plant technology needs is obtained out-of-state, via online distance delivery or is provided on-site by the employer.

Creation of this program was first considered at the request of PPL Montana, since power plants must hire trained professionals from out-of-state or provide their own costly and time-consuming training.

MSU-B COT intends to provide a public, two-year associate of applied science degree in Power Plant Technology to meet the existing and growing education needs of this industry segment. Due to the large number of power plants and related industries nationwide and the

small number of educational program providers outside of the industry, this program is expected to prepare entry-level power plant technicians for Billings, the region and the state.

b. How will students and any other affected constituencies be served by the proposed program?

This program is designed to prepare students for entry-level employment in the operation of modern fossil fuel power plants, gas turbine facilities, water treatment facilities, or other facilities where steam and/or electricity are generated. Graduates will learn the technical and safety aspects of plant operations, the responsibilities of plant operators, and the mechanical and chemical technology needed for working in related industrial operations.

Electrical power forms one of the core sectors of any economy and is a key energy source for commercial ventures, industry and home use. The industry demands qualified professionals at various levels with a complete understanding of electrical power generation and distribution systems. The electrical power generating industry is comprised of several different types of electricity-producing power plants including coal, nuclear, hydro, petroleum, geothermal, solar and wind units.

The Job
Students learn all phases of the industry including how to operate, repair, and maintain all types of power plant equipment. These include steam plants, pressure vessels and other equipment.

Students successfully completing the Power Plant Technology program will have technical knowledge that prepares them for advanced training and qualification at nuclear, fossil fuel and other types of power generating facilities. Within any power plant, there are several different entry-level opportunities, including Operations, Mechanical Maintenance, Electrical Maintenance, and Instrumentation & Control technicians.

- The plant operator monitors plant equipment parameters, operates all plant equipment, and continually checks components for proper operation. Operators hang all clearance orders to isolate systems and equipment for maintenance.
- Mechanical maintenance job tasks include trouble-shooting, repair, preventive maintenance and installation of plant equipment.
- Electrical maintenance tasks include trouble-shooting, wiring and repair of electrical components and systems.
- Instrumentation & Control technicians repair, install and maintain the instrumentation and control systems that tell the condition and status of the plant and allow operators to control various systems.

All of these positions require knowledge of power plant systems and components. Technicians must be able to obtain and use proper tools for work packages, use test equipment, and follow procedures. They must also have the ability to read mechanical and electrical prints and provide documentation.

Operating technicians can work both independently and in teams. Power Plant employees perform tasks both indoors and outdoors. Attention to detail, self-checking, and procedure adherence are requirements. Safety of the employee, co-workers, the public and the plant equipment is the number one priority of the Power Plant Technician.

c. What is the anticipated demand for the program? How was this determined?

It's an energy crisis of a new kind: The energy industry is bracing for a wave of retirements in the next ten years. As the technical workers in the energy industry get set to retire, the power industry is urging schools across the nation to begin appropriate programs to train a new generation of workers.

To meet demand for manpower, educational institutions are being asked to start up new power plant programs – the latest being Montana State University Billings College of Technology. MSU-B COT Power Plant Technology program was created in response to industry demand for qualified power plant operators--to start new workers in the energy industry's pipeline. In an industry-initiated Developing a Curriculum (DACUM) process conducted in December 2006, Montana State University Billings College of Technology was told by PPL Montana and other utilities: "We'll take every graduate you can send us."

Anyone and everyone with a power plant in the United States – municipalities, states, private-sector utilities, federal power agencies and manufacturers, as well as institutions from schools to hospitals – has a common challenge. The power industry workforce – the technicians, engineers, linemen and maintenance crews that fuel the industry – will be retiring in unprecedented numbers over the next ten years.

The energy industry is one of the first to feel the effect of Baby Boomer retirements. This is partly due to massive hiring freezes and downsizing when the industry deregulated and focused on cost-cutting measures in the 1980s and 90s.

Job demand is strong in the power plant technology field. The demand for technical workers at energy utilities and power producers is expected to soon hit a historic peak. Experts from across the nation attribute the workforce crisis within the energy industry to current and historic factors, including

- Aging of the Baby Boomers
- Energy industry deregulation in the 1980s
- Consolidation within the industry
- Rising energy demand
- Increased environmental protocols associated with the industry

A recent study by Krishnan & Associates on the aging workforce trends at U.S. coal-fired power plants, the cornerstone of the nation's power supply, found that the average age of the workforce at these power plants is 48. In its nationwide survey from 2005, K&A concluded that an average coal-fired plant will likely lose half its current plant staff in the next decade due to retirement and attrition. The study concludes that the specialized labor to replace this talent pool will likely be in short supply and difficult to recruit.

Ravi Krishnan, principal consultant at Krishnan & Associates, an executive and technical recruiting firm focused on the power-generation industry, conducted a 2005 survey of the power-generation industry which confirmed the looming shortage of power-plant workers. Krishnan said it's critical for utilities to create a workforce

environment that recognizes the needs of the next generation and recognizes that market forces now and in the future favor the job candidate (rather than the employer) in the power-generation industry.

He said, "The utilities have to put together more competitive pay packages to retain their talent and recruit. They have a lot of competition because workers can go to other firms, like original equipment manufacturers. The situation is only going to get more attractive for the average worker in the industry. I can even see that perks like signing bonuses and help in locating housing, prevalent among senior management, could become more common down the line of workers."

The Krishnan & Associates survey is echoed by a recent study from the American Public Power Association (APPA) titled "Work Force Planning for the Public Power Utilities: Ensuring Resources to Meet Projected Needs." The report states that the loss of critical knowledge and the inability to find replacements with utility-specific skills are the two biggest challenges facing the industry. As a result, the utility industry will be hit very hard, very quickly by the shortage of skilled workers. That's because, according to this report, the average age of utility workers is almost 50, several years older than the national average, and 45 percent of the workforce in electric and natural gas utilities are expected to reach retirement in the next several years. [1]

Employers often hire graduates for work in other operations besides power plants, taking advantage of their theoretical and practical training in mechanical and electrical technology. Besides power plants, job settings include research and development facilities, industrial process operations, or the sales and service fields.

3. Institutional and System Fit
   a. What is the connection between the proposed program and existing programs at the institution?

The mission of the MSU-B COT is to be the College of first choice, dedicated to the development of workforce capacity by providing top quality learning opportunities and services to meet a variety of career choices and customer needs by being responsive, flexible and market-driven. The College of Technology provides individuals with training (or re-training) to obtain excellent "in demand" positions available at many area employers.

Creation of this new program fits hand-in-glove with the College's mission and vision. The MSU-B COT Power Plant Technology Program proposal has been developed to add to existing programs which are also designed to prepare highly skilled, entry-level employees for Montana's energy industries.

[1] M.B. Reilly. The New Energy Crisis: Power Industry in for a Jolt as About Half of Workforce Readies for Retirement. University of Cincinnati News, 8/7/2006. Extracted from http://www.uc.edu/news/NR.asp?id=4226, December 1, 2006.

Using the first two semesters of the existing, standards-based program curriculum for Process Plant Technology as the common core, Power Plant Technology program semesters five and six have been developed to meet the student learning outcomes specific to Power Plant Technology.

In collaboration and in conjunction with faculty and industry content experts within the MSU-B COT Process Plant Technology program, determinations were made to utilize existing courses common to the institution's other trade and industry classes: Welding, Environmental/Shop Practices and Hazardous Materials Technician General Training.

b. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

Approval of the proposed Power Plant Technology program has required changes to the exiting MSU-B COT Process Plant Technology program. Research conducted as part of the program feasibility study indicated a need to align the existing Process Plant Technology program and the proposed Power Plant Technology program with industry standards-based curriculum created through the coordination of the Center for the Advancement of Process Technology (CAPT).[2]

Further feasibility study in preparation of the Power Plant Technology program curriculum revealed the practicality of creating a two-semester common core of courses and student learning outcomes for both Process and Power Plant Technology. Establishing a second year, focused specialty for Process and Power Plant Technology was made possible as a result of these changes. Substantive changes to the Process Plant Technology program have been submitted and approved through the College's curriculum change and approval process.

c. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

Power Plant Technology program differentiation exists between Process and Power Plant Technology in specific ways. Power Plant Operators are required to learn and utilize the technical, mechanical and safety systems utilized in **power generating plants** versus the operations and systems in a **process/refining plant.**

Power Plant Operators are required to understand the **equipment** specific and necessary for the operation of a power plant. In the Power Plant Technology program, students learn all phases of the power plant industry including how to operate, repair, and maintain all types of power plant equipment. These include steam plants, pressure vessels and other equipment.

Students successfully completing the Power Plant Technology program will have technical knowledge that prepares them for advanced training and qualification at nuclear, fossil fuel and other types of power generating facilities. Within any power plant, there are several

[2]Center for Advancement of Process Technology (CAPT). Extracted from http://www.captech.org/about/about.htm, December 2006.

different entry-level opportunities, including Operations, Mechanical Maintenance, Electrical Maintenance, and Instrumentation & Control technicians.

d. How does the proposed program serve to advance the strategic goals of the institution?

Student Success, Achievement, and Retention - In order to ensure that each student attending MSU-B COT has the opportunity to succeed and reach their educational goal, the University puts the planning and resources in place to maximize student success as measured by the student. Careful planning and forethought was devoted to the development of the new program proposal for Power Plant Technology.

Academic Excellence and Integrity – MSU-B COT maintains an atmosphere of excellence and completes all projects with integrity and as careful stewards of public resources. The five colleges at MSU-Billings will participate in a self-evaluation and external review process in an effort to ensure the highest standards of academic excellence and integrity.

Planning and Innovation – MSU-B COT strives to remain on the cutting edge of new ideas, continually planning for its future. MSU-B purposefully plans its activities and continually uses innovation to further its mission and objectives. Studying the feasibility of the new Power Plant Program began in 2005 at the request of PPL Montana.

Technology - Technology will be designed and used to further objectives of the University, community, economic development, and research to enhance the learning, business, and production environments of students, faculty, staff, and research personnel.

Development of the Power Plant Program includes plans to develop and deploy courses in online formats. To that end, MSU-B COT was successful in a bid to obtain Congressional appropriations and a National Science Foundation Grant which will support the development of curriculum, hire instructors and purchase new equipment if needed.

PPL of Montana-donated power plant simulators have been installed in our Process Plant classroom. This simulation equipment will support the new power plant program and will be available for students to operate remotely as part of their online learning experience.

Competitive Change – MSU-B COT responded to market changes with appropriate strategies that meet or exceed those of the competition with the development of this power plant program.

e. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

After Montana BoR adoption of the current Montana University System (MUS) initiatives, MSU-B COT has taken up the charge, through careful planning and industry partnership, to

assist and address the **Workforce Training & Equipment for High Demand Fields in Montana.**

To meet the state's two-year educational initiatives, the proposed MSU-B COT Power Plant Technology program adds a specific and targeted professional-technical program to the existing complement of the two-year, associate of applied science degrees in the Montana.

Collaborating to meet the goals and objectives of Montana's new face of Tech Prep; Jobs for Montana's Graduates; and postsecondary career clusters development through BILT, WIRED, Health Sciences and Apprenticeships, MSU-B COT developed the new Power Plant Technology Program proposal. Specifically, this two-year degree program was designed to increase educational pathways which match Montana's need for education and training for high demand career fields.

MSU-B COT joins the University of Montana-Missoula College of Technology's new Associate of Applied Science Degree in Energy Technology program which was designed to introduce students to the full suite of energy technologies. Graduates of the UM-Missoula COT program are best described as general practitioners. Graduates of the MSU-B COT Power Plant Technology program are best described as specialists, technicians and operators.

4. Program Details
    a. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

Montana State University Billings College of Technology
Associate of Applied Science Degree: Power Plant Technology

Upon successful completion of this program a student will be able to:

- Describe Occupational Safety and Health Administration (OSHA) industrial safety precautions related to material handling, electrical and machine safety, first response to fire and medical emergencies, safety signs and color codes, recognition of safety and health hazard accident prevention and management.
- Using power plant measuring devices and equipment, demonstrate administrative controls for precision measurement with emphasis on proper use, accurate reading, and calculations.
- Demonstrate knowledge of basic electrical laws, power sources, and circuits.
- Demonstrate maintenance procedures including defense in depth, conduct of verifications, and work control processes while applying the standards and documentation requirements to meet power plant safety and management expectations.
- Describe manufacturing properties of materials, the behavior of materials under load, stress, strain, torsion, and strength.
- Examine hand and power tools used in the power plant including safe usage, purpose, and maintenance.
- Discuss information distribution including methods and avenues of communication, material and design, procedural deficiencies of motors and equipment, operation of sensitive equipment, plant vulnerabilities, and personnel errors.
- Explain basic systems and components involving reactor coolant, volume control, safety injection, mainstream, turbine, feedwater, steam, and heater drain systems within the power plant.
- Demonstrate microcomputer software applications for the personal computer to include word processing, development of an electronic spreadsheet, and keyboarding in a desktop environment.
- Explain advanced systems and components involving water, electrical, cooling, waste drain, fuel handling and storage, fuel pool cooling and cleanup, radioactive waste management, air and gas systems, and ventilation and fire protection systems within the power plant.
- Demonstrate knowledge of renewable energy sources.
- Read blueprints and plant drawings including flow diagrams, symbols, dimension, tolerance, clearance, and amendments following proper procedures.
- Apply mathematical concepts of algebra, geometry, and trigonometry to industrial projects.

First Semester

CMP105	Introduction to Computer Technology	3 credits
MTH122	College Mathematics for Technology	3 credits
PPT101	Fundamentals of Process Technology	5 credits
PPT130	Blueprint Reading for Process Technology	2 credits
PPT151	Process Plant Safety I	2 credits
TRID185	Introduction to Electrical Systems	3 credits
		18 credits

Second Semester

ENGL140	Business Writing	3 credits
CTCM130	Intro to Public Speaking	3 credits
PPT120	Environmental Awareness	2 credits
PPT135	Instrumentation and Control Systems	3 credits
PPT161	Process Plant Safety II	2 credits
PPT175	Process Plant Sciences	5 credits
		18 credits

Third Semester

CTBU171	Introduction to Business	3 credits
COMT109	Human Relations	3 credits
PWRP201	Power Plant Equipment	3 credits
PWRP203	Energy Sources and Conversion	3 credits
PPT207	Boilers, Accessories & Basic Operation	3 credits
TRID160	Hazardous Materials Technician Gen Training	3 credits
		18 credits

Fourth Semester

PWRP210	Turbines, Accessories & Basic Operation	3 credits
PWRP214	Power Generation	4 credits
PWRP216	Electrical System Components & Protections	3 credits
PWRP218	Advanced Plant Operations (simulator)	4 credits
PWRP296	Cooperative Education/Internship	2 credits
		16 credits

Total: **70 Credits**

MSU-B COT
Associate of Applied Science Power Plant Technology
Detailed Curriculum

First Semester

CMP105 Intro Computer Tech 3 credits (Academic Foundations)
Learning Objectives
Specific Tasks Accomplished:
Textbook and Supplies Requirement: TBA

PPT101 Fund Process Technology 5 credits
(4 lecture + 2 lab)
Description: The purpose of this program is to provide an overview or introduction into the field of Process Operations within the Process Industry. Within this program, the student will be introduced to the roles and responsibilities of Process Technicians, the environment in which they work, and the equipment and systems in which they operate.
Learning Objectives: Upon completion of this course the student should have the ability to relate to an overview of a typical process plant; identify process equipment; state the purpose of equipment; describe safety, health, and environmental components; and describe the roles, responsibilities, and work environment.
Specific Tasks Accomplished: Upon completion of this course, the student will be able to:
1. Give overview of a typical process plant.
2. Identify process equipment.
3. State purpose of equipment.
4. Describe roles, responsibilities, and work environment.
5. Describe the History of the Process Industry
6. Explain a Career as a Process Technician
7. Respond to questions about Working on Teams
8. Identify Piping and Valves used in industry.
9. Respond to questions about Tanks, Drums, Pumps and Vessels

Textbook and Supplies Requirement: *PTEC Safety Health and Environmental* CAPT

MATH122 College Math Tech 3 credits (Academic Foundations)
Learning Objectives
Specific Tasks Accomplished:
Textbook and Supplies Requirement: TBA

PPT130 BP Reading for Proc Tech 2 credits
Description: This course will provide the student with an introduction in the use of Process and Instrument Drawings.
Learning Objectives: Upon completion of this course, the student will be familiar with using P&ID drawings in the course of their work as a Process Technician. In addition, the student will obtain the skills necessary to produce Process Flow diagrams.
Specific Tasks Accomplished:
1. Demonstrate proficiency in interpreting P&ID drawings
2. Demonstrate proficiency in Process Flow Sketching by drawing one major refinery or power plant operating unit.

Textbook and Supplies Requirement: Compass, protractor, process templates, graph paper, drawing pencils, eraser and eraser shield.

PPT151 Process Plant Safety I 2 credits

Description: This course will provide the student with an overview and introduction into the fields of Safety and Health within the Process Industry. In this course, the student will be introduced to various types of plant hazards, safety and health systems/equipment, and regulations under which plants are governed. Process Plant Safety is one of the eight core classes recommended by the Center for the Advancement of Process Technology (CAPT).

Learning Objectives: List components of a typical plant safety program; describe the role of a process technician in relation to safety/health; and identify and describe safety/health equipment uses.

Specific Tasks Accomplished:

Upon completion of this course, the student will be able to:

1. List components of a typical plant safety program.
2. Describe role of process technician related to safety/health.
3. Identify and describe safety/health equipment uses.
4. Describe working in the chemical processing industry
5. Describe the basic principles of safety
6. List key elements of Process Safety Management
7. List key elements of Hazard Communication
8. List key elements of Respiratory Protection
9. List key elements of Personal Protective Equipment
10. List key elements of Permit System
11. List key elements of Fire Protection, Prevention and Control
12. List key elements of Hazwoper

Textbook and Supplies Requirement: *PTEC Safety Health and Environmental* CAPT

TRID185 Introduction to Electrical System 3 credits

Description: This course introduces the student to the fundamental principles of voltage, current, resistance and magnetism. Also, these principles will be applied to series circuits, parallel circuits, and electrical meters.

Learning Objectives: This course will provide the student with a theoretical and practical background in electricity and electrical circuits to form a foundation for further study in areas of Process Plant electrical control circuits.

Specific Tasks Accomplished: Upon successful completion of this course, the student should be able to:

1. Demonstrate an understanding of voltage, current, and resistance as they apply to Ohm's law and power formulas.
2. Demonstrate an understanding of the fundamental principles of magnetism.
3. Demonstrate an understanding of color code resistors.
4. Demonstrate an understanding of electrical symbols and their use in schematic diagrams.
5. Demonstrate an understanding of series circuits, parallel circuits, and series - parallel circuits.
6. Demonstrate an understanding of electrical meters and their use.
7. Demonstrate an understanding of electrical conduction in liquid and gases.
8. Demonstrate an understanding of batteries and other electrical sources.
9. Demonstrate an understanding of magnetic induction.
10. Demonstrate an understanding of alternating current.
11. Demonstrate an understanding of inductance in alternating current circuits.
12. Demonstrate an understanding of alternating current resistive-inductive as they apply to series and parallel circuits. Demonstrate an understanding of capacitors wire in series and parallel A/C circuit.
13. Demonstrate an understanding of three phase electrical circuits.

Textbook and Supplies Requirement:

Semester One 18 credits

Second Semester

COMT130 Intro to Public Speaking 3 credits (Academic Foundations)

PPT120 Environmental Awareness 2 credits

Description: This course provides the student with the history behind certain environmental policies, the function of OSHA, EPA, DOT, State DEQ and the interrelationships which exist between these agencies. In addition, the student will examine the basic toxicology of hazardous materials and their effect upon ecological processes. The program provides learning in treatment processes, wastewater units, vapor recovery systems, cleanup, pollution prevention and an overview of the specialty equipment necessary for an ecologically sound process operation

Learning Objectives: This course is designed to provide the student with the background relevant to the creation, operation and purpose of the various agencies whose role it is to protect the environment. Particular attention will be given to examination of the current environmental policies governing industry today. The course will take a look at Federal and State regulations as they relate to the process/refining industry. The student will become aware of the various types of ecological issues in which industry must remain within compliance. The program is designed to give the student an appreciation for the monumental environmental compliance tasks which must be a part of industry's basic plan of operation. Environmental management systems will be identified and the operation of each discussed.

Specific Tasks Accomplished:

1. To equip the student with the environmental training skills necessary to approach an entry level job in a refinery/process plant with key knowledge of environmental issues.
2. Have general knowledge concerning the creation and purpose of the various State and Federal Agencies.
3. Understand and describe environmental management equipment/systems and their operation.
4. Become familiar with hazardous waste disposal methods.
5. Become familiar with basic pollution prevention techniques.
6. Develop an awareness of the environmental issues which directly affect industry and the operator's role in maintaining environmental compliance.

Textbook and Supplies Requirement: *PTEC Safety Health and Environmental* CAPT

PPT135 Instrument Control System 5 credits (3 lecture + 4 lab)

Description: The course familiarizes the student with the vocabulary surrounding the instrument and control field, as well as examining the function of each instrument. The topics of process measurements, analytical instrumentation, process controls, and instrument systems are also discussed in this course. Lab time is utilized to acquaint the student with the various systems.

Learning Objectives: The program will give the student an overall definition of process and process variables. The course is designed to allow the student to identify and describe the function of the main elements of process variables, along with the role each plays in the refining distillation processes. Students will learn about maintaining steady state operations, controlling process disturbances, and reading process variable signals. The individual will become familiar with pressure, temperature, level, and flow measuring instruments. General knowledge will be gained during the discussion of analytical instrumentation and the operation of transmitters, transducers, recorders, indicators, controllers and control stations. Extensive lab time will allow the student hands on experience and observation in the above process variables. Written lab reports will be required of each student.

Specific Tasks Accomplished:

1. The student will be able to define and have a working knowledge of process, process variable, and controlled variable.
2. Describe what pressure, temperature, level, and flow measuring and indicating instruments are and how they work with/against each other.

3. The student will describe the purpose and role of instrument systems and instrument loops.
4. Explain and describe the purpose of control systems, as well as the various control system types.

Textbook and Supplies Requirement: *PTEC Instrumentation* CAPT

PPT161 Process Plant Safety II 2 credits

Description: This course will provide the student with detailed instruction in the field of Safety and Health within the Process Industry. In this course, the student will complete an in depth study in the use of gas detection equipment, the use of the permitting system including lock out/tag out, the use of OSHA logs, the use of advanced safety equipment and study the importance of Industrial Hygiene in an industrial setting.

Learning Objectives: List and be familiar with the advanced components of a plant safety program.

Specific Tasks Accomplished: Upon completion of this course, the student will be able to:

1. Demonstrate proficiency in the use of gas testing equipment
2. Demonstrate proficiency in the use of industrial permitting systems.
3. Demonstrate the use of advanced personal protective equipment
    a. Examples: Respirators, fall protection equipment, eye protective devices, self contained breathing apparatus (SCBA) etc.
4. Explain the function of Industrial Hygiene in an industrial setting.
5. Demonstrate a knowledge of IH testing and procedures
6. Demonstrate the use of Material Safety Data Sheets

Textbook and Supplies Requirement: *PTEC Safety Health and Environmental* CAPT

PPT175 Process Plant Sciences 5 credits

Description: The Process Plant Sciences course provides the fundamentals necessary for the student to take a deeper look into the chemical processing. This course examines the concepts of chemical composition/reaction, fluid flow and pressure drop, as well as vapor-liquid equilibrium, simple machines, basic electric circuits, furnaces, adsorption, leaching, and refrigeration. This will give the student a better understanding of the processes taking place in the chemical industry.

Learning Objectives: The program is designed to give the student an understanding concerning some of the basic scientific principles and their applications in a process facility. The student will become familiar with the fundamental units of measurement for length, time, and mass as they related to pressure, temperature, flow, and level. This course will teach the student the relationship between force, motion, and energy, as well as the properties of matter associated with solids, liquids, gases, and flowing fluids. The student will gain a basic knowledge of equilibrium in distillation systems. Included in this will be the effects of temperature and pressure and their effects on separation.

Specific Tasks Accomplished:

1. The student will understand basic physical/chemical scientific principles and natural laws and as they apply to process systems operation.
2. Define units of measurement and natural laws that relate to force, motion, mechanics, and fluid dynamics.
3. Explain specific heat, sensible heat, and latent heat
4. The student will have knowledge and an understanding of the properties of matter associated with solids, liquids, and gases.
5. The student should be able to explain the distillation process as it relates to vapor pressure of the components being separated.

Textbook and Supplies Requirement:

1. Schaum's Outline of Applied Physics 3rd ed. by Arthur Beiser, McGraw Hill 1995.
2. Schaum's Outline of Beginning Chemistry by David E. Goldberg McGraw Hill 1991

Semester Two 17 credits

Third Semester

PWRP201 Power Plant Equipment 3 credits

Description: Students will be given an introduction to the major systems and components that make up a modern power plant. Students learn how electric power is produced and distributed; how boilers, turbines, and condensers operate; and what the general responsibilities of plant operators are during all phases of plant operation. Specific attention is given to the flow of water and steam through the steam cycle, how combustion occurs, types of boilers and turbines, operation of steam cycle support systems, bearings and lubrication, turbine control, pollution control, and plant safety. This course covers the various types of equipment used in the production of electricity, including pumps, valves, air compressors, coal pulverizers, fans, cooling towers, condensers and heat exchangers.

Learning Objectives: The student will become familiar with all major equipment associated with the generation and distribution of electrical power.

Specific Tasks Accomplished: Upon completion of this course the student will be able to:

1. Explain the purpose of all major power plant equipment.
2. Explain the interrelationships of all major power plant equipment.
3. Explain power distribution systems from point of generation to final use by the consumer.
4. Explain surveillance and routine job tasks associated with major power plant equipment.
5. Explain the scientific basis for electrical generation.

Textbook and Supplies Requirement: TBA

PWRP203 Energy Sources and Conversion 3 credits

Description: Students will study the various forms of energy and the processes used to convert chemical and potential energy into thermal, mechanical and in some instances electrical energy. Energy sources that will be studied include fossil fuels (coal, oil and natural gas), hydro, wind, fuel cells, solar, derived fuel, geothermal and nuclear. Combustion and reaction will be discussed in detail for those energy sources that require combustion to covert from one energy form to another.

Learning Objectives: The student will become familiar with the different types of fuels used in the production of electrical power.

Specific Tasks Accomplished: Upon completion of this course the student will be able to:

1. Describe all fuel sources used in power plants for the production of electricity.
2. Explain the advantages and disadvantages of each type of fuel used in a power plant for the production of electricity.
3. Explain the types of equipment required for each type of fuel used in a power plant for the production of electricity.
4. Explain the basics of fuel combustion.
5. Demonstrate an understanding of fuel optimization and various control techniques.

Textbook and Supplies Requirement: TBA

PPT207 Boilers, Accessories Basic Operation3 credits

Description: This course offers an introduction to boiler equipment, controls, and systems. Instruction includes the function and operation of all major components and control devices, common troubleshooting problems and common maintenance concerns.

Learning Objectives: The student should learn about basic design, components and operation of steam generation systems**.**

Specific Tasks Accomplished:

1. The student will understand the operation of steam systems within an industrial complex.
2. The student will learn condensate recovery systems, steam trap systems and boiler feed water preparation.

3. The student will understand the operation of equipment associated with a plant's steam system such as steam turbines, heat tracing and various other processing equipment.

Textbook and Supplies Requirement: TBA

TRID160 HazMaterials Techn Gen Trng 3 credits
Learning Objectives
Specific Tasks Accomplished:
Textbook and Supplies Requirement: TBA

Semester Three 18 credits

Fourth Semester

ENGL140 Business Writing 3 credits
Learning Objectives
Specific Tasks Accomplished:
Textbook and Supplies Requirement: TBA

PWRP210 Turbines, Acc & Bas Op 3 credits
Description: Students will study all the elements that make up gas and steam turbines, a combined cycle unit and associated auxiliary systems. This course also covers the safe and efficient operation of gas turbines and heat recovery steam generators and their different applications as used in combine cycle and cogeneration configurations. Students will learn how thermal energy is converted to mechanical energy as the steam passes through a typical industry steam turbine. Steam turbine start-up and shut-down procedures will also be studied.
Learning Objectives: The student will learn the safe and efficient operation of turbines and associated auxiliary systems.
Specific Tasks Accomplished: Upon completion of this course the student will be able to:

1. Explain the safety aspects of turbine operation.
2. Demonstrate knowledge of turbine design and associated systems.
3. Explain the basis for steam to energy conversion.
4. Explain turbine optimization.
5. Explain the interrelationship between turbines and their associated equipment.
6. Explain turbine operating procedures and theory.

Textbook and Supplies Requirement: TBA

PWRP214 Power Generation 4 credits
Description: Introduces the basic elements of generator design, protection, and operation. Students are introduced to the theoretical aspects of reactive power in power systems by analyzing the inductive and capacitive components of the system, with an emphasis on megavar loading as it is affected by the excitation system. The generator`s auxiliary systems, including hydrogen cooling systems, stator cooling systems, seal oil systems, and generator degassing procedures, are also introduced, and the function and types of exciters commonly found in power plants are examined.
Learning Objectives: The student will learn the theory and basis of power generation through detailed study of electrical generators and associated equipment. Emphasis will be placed upon examining electrical generation equipment and the scientific laws and principles supporting their operation.
Specific Tasks Accomplished: Upon completion of this course the student will be able to:

1. Explain the generation of electricity through the use of electromagnetism.
2. Demonstrate a knowledge of electrical generator design and associated systems

3. Explain the scientific basis for electrical power generation using various scientific laws and principles.

Textbook and Supplies Requirement:

PWRP216 Electrical System Components and Protection 3 credits

Description: Introduces typical devices used to protect personnel and prevent damage to plant equipment. Also covered are generator, bus, and line differential protection, as well as high- and low-pressure protection. The material presented includes trip and alarm logic for chemical protection, turbine protection, boiler protection, and generator protection. Devices covered include fuses over current relays, and over-and under-voltage relays. The course covers practices for electrical protection of plant equipment and personnel.

Learning Objectives: The student will learn the function and application of various personnel and equipment devices associated with electrical power generation.

Specific Tasks Accomplished: Upon completion of this course the student will be able to:

1. Demonstrate knowledge of power generation equipment alarms and shutdown systems.
2. Demonstrate knowledge of power generation equipment protective devices.
3. Demonstrate knowledge of power distribution protective devices.
4. Demonstrate knowledge of power distribution monitoring devices.

PWRP218 Advanced Plant Operations and Troubleshooting 3 credits

Description: Students will gain the knowledge necessary to comprehend overall power plant operations and respond to abnormal operating conditions. Students will also participate in root cause analysis exercises while troubleshooting different operating scenarios

Learning Objectives: The student will learn various techniques to identify operating problems within a power generation facility and the steps necessary to perform corrective action measures.

Specific Tasks Accomplished: Upon completion of this course the student will be able to:

1. Demonstrate the ability to determine the cause(s) a variety of power generation operating problems.
2. Demonstrate knowledge of corrective action techniques used in a power generation facility to correct system problems and upsets.

Textbook and Supplies Requirement:

PWRP296 Cooperative Ed/Internship 2 credits

Description: Provides students with the opportunity to supplement coursework with practical work experience related to their educational program. Students work under the immediate supervision of experienced personnel at the business location and with the direct guidance of the instructor.

Learning Objectives:

1. The student will gain on-the-job experience in the power generation industry with practical application.
2. The student will apply classroom knowledge in an actual power generation facility.
3. The student will gain an appreciation for power generation system and it's techniques.

Specific Tasks Accomplished: The student will observe and learn the tasks commonly associated with power plant operator duties. Throughout the internship, the student and his/her direct supervisor will provide updates to the PWRP program director. Upon completion of the program, the student will provide a detailed report to a dissertation committee comprised of a representative from the internship site, one subject matter expert and the PWRP program director. Student progress will be documented by written reports from the student.

Semester Four 16 credits

Total Program Credits: 70

b. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

MSU-Billings College of Technology
Associate of Applied Science Power Plant Program Implementation

	Spring 2008	***Fall 2008***	***Spring 2009***	***Fall 2009***	***Spring 2010***
Implementation Step	Advertise new program	Admit 1st program cohort		Admit 2nd student cohort	Graduate 1st student cohort
# New Students		24		24	24
Enrolled Cohort			24	24	24
Total Students		***24***	***24***	***48***	***48***

5. Resources
   a. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

      Yes.

      MSU-B COT has allocated a permanent faculty line in the budget. This resource will be used to hire a program faculty member/ coordinator who will teach courses, advise students, coordinate necessary programmatic laboratories and maintain equipment. In addition, our new faculty member will work with industry to refine the curriculum and develop partnerships with industry and secondary schools.

      Montana State University-Billings College of Technology received **$745,000** in Congressionally-directed grant funding from the US Department of Education to develop program curriculum, submit program approval proposals and acquire and install program-specific equipment.

      Additionally, Montana State University-Billings College of Technology received **$546,000** from the National Science Foundation to purchase and install Plant Simulation software than can be operated via the Internet. Create online laboratory exercises to accompany the software and process simulator. Prepare Power Plant operating and procedural guides for other institutions to use and implement.

      Both sources of external funding are being used to develop the curriculum and hire consultants to assist with completion of the grants' outcomes.

b. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

Facilities/Supplies
MSU Billings' and COT executive administrators provide financial and facility resources sufficient to support continuity and consistency in the educational program. Costs will be funded through tuition, fees and the State allocation as in previous years.

The Power Plant Program will be offered in MSU-B COT facility space co-existent with the Process Plant Program. A new Health Science Center is under construction and targeted for completion in early 2008. With this new construction, vacated spaces in the existing COT building will be remodeled to provide for program growth and expansion.

Equipment
In 2005, Montana legislators approved appropriations to support 2-year education's equipment and program needs. Over $71,000 was allocated and spent in anticipation of instructional equipment needed for the proposed ASN program.

Operating cost budgets have been established to maintain this new equipment and purchase the supplies needed for the proposed ASN program.

6. Assessment.
How will the success of the program be measured?

Program Review:
MSUB is a student centered campus that focuses on excellence in teaching and student learning. During the last several years MSUB has re-examined, strengthened, and coordinated its assessment process. While institutional evaluation and assessment is by its nature continuously evolving, the University has made progress toward an institutional assessment lattice integrated into the university's strategic plans. In fall 2004 the university initiated its second strategic initiatives document for the period 2005-2010. The document was collaboratively developed with faculty and staff and implemented in fall 2005 as the University instituted a Continuous Quality Improvement concept in all its practices. The CQI process is continual and cyclical, allowing for annual progress checks and data informed decision making. The Continuous Quality Improvement Steering Committee oversees implementation of the CQI concept in all University processes. The Committee maintains a website and publishes a monthly Newsletter *CQI-FYI.*

Each division of the university (Academic Affairs, Administrative Affairs, Athletic Affairs, Facility Services, Graduate Studies, Grants and Sponsored Programs, Information Technology, Institutional Research, Library, Public Service Units (KEMC/YPR and the Montana Center on Disabilities) and Student Affairs) developed goals aligned with the university strategic initiatives Both quantitative and qualitative measures are required to assess performance and outcomes.

Annual program reviews are conducted in each division, each college, and each department within each college and administrative divisions with sub-units to review and assess compliance with the University's overall mission. The CQI process is an ongoing evaluation of the University's mission and role and a continual attempt to match our offerings to constituent needs. Coordination of assessment is overseen by the CQI Steering Committee and the Academic Senate. The committee meets on a regular basis to discuss, review and provide feedback to the various areas of the university. The outcomes are used in planning and implementing changes for improvement. The Co-Chairs of the Committee make a monthly presentation of the committee's activities and progress on assessment to the Chancellor and his Cabinet during regularly scheduled cabinet meeting.
It involves administration, faculty, students, the Power Plant Program Advisory Board (PAB), graduates and employers. A model was developed to identify the evaluative components, input sources, process, timeline, and outcomes criteria.

In Academic Affairs, assessment involves multiple instruments and methodologies. In contrast, Administrative Services and other areas use fewer tools to measure their more discrete area of operation. Each of the areas, however, employs varying appropriate quantitative and qualitative tools to assess their areas in relation to the same overriding criteria:

- Does the program or function assessed move the University closer to its mission?
  MSU-Billings provides a university experience characterized by:
  Excellent Teaching
  Support for Individual Learning
  Engagement in Civic Responsibility
  Intellectual, Cultural, Social & Economic Community Enhancement

- Does the program or function assessed move the University closer to its standard of *Access and Excellence*?

- Does the program or function assessed contribute to fulfillment of the University's Strategic Initiatives?
  Programs—Create and maintain distinctive, vital academic programs and services for 21st Century learners
  Faculty Excellence—Cultivate excellence in & outside the classroom, in scholarly endeavors & exemplary service through faculty & staff development, support for scholarship, continuing assessment, & recognition of professional service
  Needs of Learners—Identify the needs of all learners & provide access to a university experience that fulfills both individual goals & societal needs
  Social Equity—Model social equity and consciousness by assuring that all members of our campus community grow because of their University experience
  Research Initiatives—Increase the stature, professionalism & research initiatives of all academic programs & student services
  Economic Access—Augment local, state & regional economic development through the strength of the University's financial base & our learners' contributions to their communities

Global Engagement—Increase staff, faculty & student awareness, understanding, & involvement in the international community
University Infrastructure—Ensure an administrative, operational and physical infrastructure that fully supports excellence

- Does the program or function assessed help the University attain its Vision?
  Montana State University-Billings will be recognized as a regional leader for:
  Teaching & Learning
  Translating Knowledge into Practice
  Researching for the Future
  Accepting Leadership for Intellectual, Cultural, Social & Economic Development
  Beyond University Boundaries

Assessment Data

Annual Reports: provide evidence of progress toward division/unit goals, data to support this progress and other information as appropriate for the area.

Periodic Program Review: MSU-B COT complies with the Montana Board of Regents Policy 300.3 under Academic Affairs Program Review. MSU-B COT will review all of its programs at least once every seven (7) years. A campus schedule of review for our programs has been filed with the Office of the Commissioner of Higher Education. Upon approval of the Power Plant Technology Program, that schedule will be updated. The results of our internal Power Plant Program review will be prepared to submission to the Montana Board of Regents at the November meeting. This report focuses especially on the decisions associated with the future of each program, following its review.

Student Ratings of Instruction: In general, evaluation of faculty is governed by the Collective Bargaining Agreement between the Montana Board of Regents of Higher Education and Vocational-Technical Educators of Montana. Faculty member evaluation procedures are recognized to be a cooperative effort between the faculty member and his/her supervisor with the purpose of achieving excellence in the area of effective and purposeful instruction and job performance.

Surveys: Graduate and Employer satisfaction surveys will be administered on an annual basis. Results of these surveys will be considered by the Dean, Associate Dean, Department Chair, members of the Program Advisory Committee. Recommendations from the Committee for needed revisions to course content or presentations are to be discussed with and adopted by teaching faculty each fall semester.

The timeline for evaluation affords ample time for program revision based on the evaluative data, changing trends in power plant industry standards. Components of the evaluation model include the organization and administration of the program, curriculum, resources, and student/graduates. Graduate and graduate employer surveys will be administered annually.

7. Process Leading to Submission
   Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

Process	Approval/Consideration	Status/Date
Power Plant Developing a Curriculum (DACUM) Process	2-day, facilitated curriculum development with 5-member panel of industry experts: Power Plant Operators	December 2006
New Power Plant Program Proposal	MSU-B COT Curriculum Committee	Approved, April 25, 2007
New Power Plant Program Proposal	MSU-B Undergraduate Curriculum Committee	Fall 2007 review
New Power Plant Program Proposal	MSU-B Academic Senate	Fall 2007 review
New Power Plant Program Proposal	Montana BoR Level II New Program Proposal	Submitted for September 2007 meeting