

College of Micronesia – FSM
P.O. Box 159
Kolonia, Pohnpei

Course Outline Cover Page

Applied Mechanics II
 Course Title

ME 228
 Department and Number

Course Description: This course will provide the student with the knowledge and skills required to explain and calculate the basic affects of force, pressure, displacement, thermal expansion and friction on machinery and structural components.

Prepared by: Brent Villiers

State: FSM-FMI

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3/6/12/24	16/8/4/2	48	3
Laboratory	3/6/12/24	16/8/4/2	48	1
Total Semester Credits:				4

Purpose of Course

Degree Requirement	_____XX_____
Degree Elective	_____
Advanced Certificate	_____
Certificate	_____
Remedial	_____
Other (Workshop)	_____

Prerequisite Course(s): ME 221 Applied Mechanics I

Signature, Chairman, Curriculum Committee

Date Approved by Committee

Signature, President, COM-FSM

Date Approved by the President

General Objective: On successful completion of this course, the student will be able to explain and calculate the basic affects of:

- Force;
- Pressure;
- Displacement;
- Thermal expansion; and
- Friction

on machinery and structural components.

Learning Outcomes: On successful completion of this course the student will be able to:

1. Determine the centers of area and gravity of regular shapes encountered on vessels.
2. Investigate the effect of forces and moments on plane surfaces and beams.
3. Investigate the linear and angular kinematics of motion of rigid bodies.
4. Investigate the kinetics of rigid bodies under constant force or torque.
5. Investigate the effect of friction on dry horizontal planes and bearings.
6. Determine the stress and strain in engineering components.
7. Investigate the stress in thin walled pressure vessels.
8. Determine the thermal expansion of metals and liquids.
9. Investigate the kinematics of machines.

STUDENTS SHOULD BE MADE AWARE OF OCCUPATIONAL HEALTH AND SAFETY ISSUES IN ALL SITUATIONS AND BE EXPECTED TO DEMONSTRATE SAFE WORKING PRACTICES AT ALL TIMES.

Outline of Content:

This course contains:

1. Area, Volume, and Mass
 - Centre of area
 - Centre of gravity
2. Statics
 - Force and pressure
 - Vectors
 - Resultants and equilibrium
 - Components of forces
 - Moments and couples
 - Bending moments

3. Kinematics

- Linear and angular motion
- Displacement and velocity
- Uniform acceleration
- Relative velocity

4. Dynamics

- Momentum, work, torque, and power
- Potential, kinetic, and strain energy
- Conservation of energy
- Newton's laws of motion

5. Friction

- Coefficient of friction
- Friction forces
- Lubrication

6. Stress and Strain

- Direct stress, strain, and Hook's Law
- Shear stress
- Ultimate tensile strength and factor of safety
- Working stress and safe working loads

7. Thin Walled Pressure Vessels

- Circumferential and longitudinal stress
- Factor of safety

8. Thermal Expansion

- Linear thermal expansion of metals
- Volumetric expansion of liquids
- Clearances and shrink fit
- Stress due expansion restriction
- Superficial and cubical expansion
- Apparent cubical expansion

9. Machines

- Rope and pulley blocks
- Hydraulic and screw jacks
- Warwick screws
- Worm and wheel gears
- Crab winches
- V belt and pulleys

Learning Outcomes:	On completion of this course the learner will be able to:
Learning Outcome 1	Determine the centers of area and gravity of regular shapes encountered on vessels.
Assessment criteria	<ol style="list-style-type: none"> 1.1 The centers of area of common regular shapes are defined and calculated. 1.2 The centers of gravity of regular shapes are defined and calculated. 1.3 The centers of area and gravity of shape built up from regular shapes are calculated.
Conditions and Method of assessment	<p>As specified in the Assessment Strategy listed at the end of this outline and by a combination of:</p> <ul style="list-style-type: none"> • Written assessment • Calculations • Assignments • Oral assessment
Learning Outcome 2	Investigate the effect of forces and moments on plane surfaces and beams.
Assessment criteria	<ol style="list-style-type: none"> 2.1 Resultant and equilibrant of a system of coplanar forces are calculated. 2.2 Force vectors are solved using force polygons. 2.3 Forces are resolved along rectangle coordinates in one plane. 2.4 Moments and couples of forces are calculated. 2.5 Types of beam supports and loads applied are described. 2.6 Bending moments and support reactions of simply supported and cantilever beams under point loads are calculated.
Conditions and Method of assessment	<p>As specified in the Assessment Strategy listed at the end of this outline and by a combination of:</p> <ul style="list-style-type: none"> • Written assessment • Calculations • Assignments • Oral assessment • Practical assessment

Learning Outcome 3**Investigate the linear and angular kinematics of motion of rigid bodies.**

Assessment criteria

- 3.1 The relationship between linear and angular motion is derived.
- 3.2 The relationships between displacement, velocity, and uniform acceleration for linear and angular motions are derived and expressed as formulae.
- 3.3 Using the derived formulae, simple problems involving displacement, velocity, and acceleration are solved.
- 3.4 Relative velocities of objects in one plane are determined.

Conditions and Method of assessment

As specified in the Assessment Strategy listed at the end of this outline and by a combination of:

- Written assessment
- Calculations
- Assignments
- Oral assessment
- Practical assessment

Learning Outcome 4**Investigate the kinetics of rigid bodies under constant force or torque.**

Assessment criteria

- 4.1 Motion of objects under a constant force is calculated.
- 4.2 Torque and its relationship to force, power, and gear ratio are defined and related problems solved.
- 4.3 Mass-Spring systems, their relationship, and spring energy are identified and related problems solved.
- 4.4 Using the principles of conservation of energy, problems involving energy and power are solved.
- 4.5 Centrifugal and centripetal forces are defined and calculated.
- 4.6 Action of centrifugal weight in governors is explained.

Conditions and Method of assessment

As specified in the Assessment Strategy listed at the end of this outline and by a combination of:

- Written assessment
- Calculations
- Assignments
- Oral assessment
- Practical assessment

Learning Outcome 5	Investigate the effect of friction on dry horizontal planes and bearings.
Assessment criteria	<p>5.1 The coefficient of friction is defined and calculated.</p> <p>5.2 Frictional force on a horizontal plane is calculated.</p> <p>5.3 Effects of lubricating oil, including bearings lubrication, are described.</p> <p>5.4 The heat dissipated in a journal bearing is calculated.</p>
Conditions and Method of assessment	<p>As specified in the Assessment Strategy listed at the end of this outline and by a combination of:</p> <ul style="list-style-type: none"> • Written assessment • Calculations • Assignments • Oral assessment • Practical assessment
Learning Outcome 6	Determine the stress and strain in engineering components.
Assessment criteria	<p>6.1 Problems involving direct stress, direct strain, and modulus of elasticity are solved.</p> <p>6.2 Problems involving safe working loads and factor of safety are solved.</p> <p>6.3 Shear stress in simple situations, such as bolted joints, is calculated.</p>
Conditions and Method of assessment	<p>As specified in the Assessment Strategy listed at the end of this outline and by a combination of:</p> <ul style="list-style-type: none"> • Written assessment • Calculations • Assignments • Oral assessment • Practical assessment
Learning Outcome 7	Investigate the stress in thin walled pressure vessels.
Assessment criteria	<p>7.1 The circumference and longitudinal stress in thin walled pressure vessels are defined and calculated.</p> <p>7.2 Factor of Safety in relation to pressure vessels are defined.</p>

Conditions and
Method of assessment

As specified in the Assessment Strategy listed at the end of this outline and by a combination of:

- Written assessment
- Calculations
- Assignments
- Oral assessment
- Practical assessment

Learning Outcome 8

Determine the thermal expansion of metals and liquids.

Assessment criteria

- 8.1 Linear thermal expansion of metals are defined and calculated.
- 8.2 Machinery clearances and shrink fits in relation to thermal expansion are explained.
- 8.3 Stress due to the restriction of thermal expansion is calculated.
- 8.4 Superficial and volumetric expansion are defined and calculated.
- 8.5 The volumetric expansion of liquids are defined and calculated.

Conditions and
Method of assessment

As specified in the Assessment Strategy listed at the end of this outline and by a combination of:

- Written assessment
- Calculations
- Assignments
- Oral assessment
- Practical assessment

Learning Outcome 9

Investigate the kinematics of machines.

Assessment criteria

- 9.1 The operation and advantage of rope and pulley blocks, screw jacks, hydraulic jacks, worm and wheel gears, and Warwick screws are explained.
- 9.2 The velocity ratios, mechanical advantage, and efficiency of the above machines are calculated.
- 9.3 Experimental results of lifting machines are analyzed.
- 9.4 The operation and advantage of Flat/V belt and pulleys are explained and their speed ratios are calculated.

Conditions and Method of assessment	<p>As specified in the Assessment Strategy listed at the end of this outline and by a combination of:</p> <ul style="list-style-type: none"> • Written assessment • Calculations • Assignments • Oral assessment • Practical assessment
<u>Delivery strategy</u>	<p>The course provides for delivery by on and off-the-job training and assessment.</p> <p>Some areas of content may be common to more than one learning outcome, and therefore integration of training and assessment may be appropriate.</p> <p>Methods of instruction includes:</p> <ol style="list-style-type: none"> 1. Classroom lectures with handouts, course notes, overhead transparencies (or equivalent), slide presentations, video material, and whiteboard notes; 2. Calculation via examples and tutorials; and 3. Practical demonstrations.
<u>Resource requirements</u>	<p>Delivery of the training will require:</p> <ul style="list-style-type: none"> • Classroom • Whiteboard • Overhead projector (or equivalent) • Access to appropriate vessels or models. • Video player • Extension meter (or equivalent)
<u>Assessment Strategy</u>	
Assessment Method	<p>Knowledge based criteria will be satisfied through a combination of calculations, written and oral assessments.</p> <p>Skill based criteria will be satisfied through practical exercises.</p>
Condition of Assessment	<p>This course may be assessed on and off-the-job. Competence may be assessed in the following situations: classroom; laboratories; and appropriate vessels.</p>

Evaluation:

Final Grade for this course will be based on meeting the course requirements at the following percentage rates:

96% - 100%	A – Superior
90% - 95%	B – Above Average
80% - 89%	C – Average
69% - 79%	D – Below Average
0 % - 69%	F – Failure

Attendance:

The COM-FSM attendance policy will apply.