OET007 Statics Rubric Guide **Updated May 2, 2017**

The purpose of this guide is to provide a range of knowledge at which students can demonstrate proficiency for each objective. Subsequent college course success depends strongly on courses taught primarily at the "some applied skills demonstrated" and "applied skills strongly demonstrated" levels.

TAG Learning Outcomes	Applied skills strongly demonstrated	Some applied skills demonstrated	Little applied skills demonstrated	No applied skills demonstrated
1. Break force vectors into component and combine forces into a resultant.*	• Determine which method would be most efficient in a particular problem. • Calculate the resultant of three or more coplanar concurrent or coplanar non-concurrent force vectors by method of components. • Resolve any vector into components along any two axes.	• Be able to apply, graphical, mathematical and components methods given different information. • Combine 2 concurrent, coplanar forces into a resultant by method of components and/or using trigonometry. • Combine 3 concurrent, coplanar forces into a resultant graphically.	• Explain and discuss the graphical, mathematical and components methods. • Determine right angle components of a vector in standard x and y directions. • Determine the resultant of two perpendicular vectors. • Combine 2 concurrent, coplanar forces into a resultant graphically.	• Define vector, and distinguish between vector and scalar quantities. • Define component and resultant.
2. Determine moments and couples.*	• Recognize when a couple is created by the components of two force vectors. • Determine the net moment about a point due to a force system. • Convert distributed loads (both uniform and non-uniform) to concentrated loads. • Calculate equivalent couples.	• Calculate the moment of a force not at a right angle to a moment arm, using components and Varignon's theorem. • Use the principle of transmissibility in calculations of moments. • Replace a force with a force and a couple.	• Recognize couples and describe their effect on a body. • Calculate the moment of a force at a right angle to a moment arm. • Determine the sense (positive or negative) of an applied moment. • Calculate the moment of a couple.	• Define transmissibility. • Define moment and couple.
3. Evaluate systems in force and moment static equilibrium.*	• Apply the three equations of equilibrium to determine the magnitude and direction of unknown force(s) in a system. • Apply Newton's first law to	• Calculate reaction forces at supports. • Draw complete and accurate free body diagrams of coplanar force systems	• Experimentally determine unknown quantities (force magnitudes and/or directions) in concurrent, coplanar force systems.	• Define static equilibrium. • Describe how Newton's third law is used in the creation of free body diagrams.

	coplanar force systems and calculate unknown quantities (force magnitudes and/or directions). • Evaluate complex concurrent, parallel and non-concurrent systems.	applied to rigid bodies, including support reactions. • Determine if a rigid body is over, under, or properly constrained. • Apply Newton's first law to parallel, coplanar force systems and calculate unknown quantities (force magnitudes and/or directions).	• Apply equilibrium equations to concurrent coplanar forces. • Draw complete and accurate free body diagrams of concurrent, coplanar force systems.	• Define free-body diagram. • List the three equations of equilibrium.
4. Determine forces on members in a truss, frame, and pulley.*	• Determine the tension in a cable that is part of a complex, multi-pulley system. • Analyze machines using method of members. • Analyze trusses using method of joints. • Analyze trusses using method of sections. • Analyze frames using method of members.	• Determine the tension in a cable of a simple pulley system. • Draw a complete free body diagram of each member of a frame. • Draw a complete free body diagram of each member of a machine. • Identify which members of a given truss under a prescribed loading condition would be zero force members.	• Draw free body diagrams for simple truss analysis. • Explain two force and three force member and describe the conditions under which each can be in equilibrium. • List the assumptions used in truss and frame analysis. • Describe method of joints, sections, and members; and the appropriate conditions under which each would be applied.	• Be able to differentiate between structures and machines. • Define a truss, frame, and pulley.

5. Apply friction laws to direction, wedges, belt, disk, and incline.*	• Evaluate a system that includes one or more wedges. • Apply laws of friction to flat belts, ropes, or cables. • Apply laws of friction to screws.	• Determine whether an object will tip or slide. • Calculate friction force on incline planes. • Experimentally estimate the coefficient of static friction between two surfaces. • Graphically represent the stages of dry friction. • Determine the stage a system is in (static, impending, moving).	• Draw free-body diagrams which include friction force and normal force. • Correctly draw and calculate the angle of friction. • Determine maximum static friction. • Define impending motion. • Calculate friction force on horizontal surface.	• Define normal force, friction force, coefficient of friction, angle of friction. • Differentiate between dry, rolling, and wet (lubricated) friction. • Define static and kinetic friction.
6. Determine the centroid of areas.*	• Calculate centroid of composite geometric shape with voids. • Find centroid of a complex shape with voids. • Invert the x and y axis as part of a composite shape.	• Calculate centroid of composite structural shape. • Calculate centroid of composite geometric shape. • Invert the x and y axis of a defined shape. • Apply parallel axis theorem to solve composite shape. • Determine when to use centroid of a line or area and solve real life problems.	• Calculate centroid of simple shape. • Apply tables to find centroid of defined shapes. • Define parallel axis theorem. • Determine the centroid of a line.	• Define what a centroid is. • Determine through experimentation the centroid of an area. • Differentiate between centroid and center of gravity.

7. Determine moments of inertia.*	• Calculate the moment of inertia of composite shapes with voids. • Use the parallel axis theorem and tabulated data to calculate moment of inertia of standard structural shapes.	• Calculate the radius of gyration of an area. • Apply the parallel axis theorem to determine moment of inertia of composite geometric areas. • Invert the x and y axis of a defined shape.	• Calculate the moment of inertia of simple shapes about their centroid. • Apply tables to find the moments of inertia of simple shapes. • Apply tables to find the moment of inertia of structural shapes.	• Define moment of inertia. • Describe the reason for determining the planar moment of inertia.
8. Analyze forces, unit vectors, and components in 3-D.	• Evaluate both concurrent and non-concurrent systems that are in three-dimensional equilibrium.	• Resolve a 3-D force vector into its x, y, and z components. • Calculate resultant of forces along x, y and z axis.	• Determine the resultant of parallel forces in 3-D space.	• List the six basic equations for three-dimensional equilibrium. • Define resultant, component, and equilibrium in 3D.