APPLY AUTOMOTIVE ENGINEERING SCIENCE PRINCIPLES

UNIT CODE: ENG/OS/AUT/CC/3/06

UNIT DESCRIPTION

This unit describes the competencies required by a technician in order to apply a wide range of automotive science principles in their work. It includes using concepts of science, resolution of forces, determining effects of various loads on engineering systems, analyse properties of materials, determine parameters of a fluid system, describe the nature of friction and apply the gas laws.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***.
1. Resolve forces	1.1 Forces are defined as per reference 1.2 Theorems are stated and explained 1.3 Forces are resolved as per theorems 1.4 Resultant forces are determined as per the methods.
2. Determine effects of loads in automotive systems.	2.1 ***Types of forces*** are identified 2.2 Equilibrium of forces and plane framework are calculated 2.3 Point loads are analyzed as per procedure. 2.4 Principle of moments is stated as per reference

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3. Analyse properties of materials	3.1 ***Mechanical properties and stress*** are identified in accordance with standard 3.2 Mechanical properties of a materials are tested as per procedure 3.3 Direct, shear and torsion stresses are calculated as per formula 3.4 Factors affecting choice of materials are identified
4. Determine the nature of friction in automotive systems	4.1 Friction is defined from reference 4.2 Laws of friction are stated as per reference 4.3 Effects of friction are identified from experiments 4.4 Forces to overcome friction are calculated for various situations 4.5 Tools and equipment are operated
5. Solve problems related to motion.	5.1 Terms are defined according to reference 5.2 Laws of motion are stated as per reference 5.3 Parameters of motion are calculated. 5.4 Motion graphs are drawn for

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	different situations. 5.5 Relationship between linear and angular motion is established from formula 5.6 Motion of a vehicle on a curved and banked track is analysed as per the laws of motion.
6. Apply simple machines concepts	6.1 Terms related to machines are defined from reference 6.2 Simple machines are described from design. 6.3 The law of machine is applied from formula 6.4 Machines performance indicators are determined from law
7. Determine the effect of heat and apply the gas laws	7.1 Terms are defined in accordance with reference 7.2 Effects of heat on matter are identified from experiments. 7.3 Modes of heat transfer are identified from observation 7.4 Gas laws are stated from reference 7.5 Quantity of heat and temperature are measured using instruments 7.6 Problems on heat and gases are

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	calculated from formula
8. Use the concept of density and pressure	8.1 Terms are defined from reference 8.2 Parameters are measured using instruments 8.3 Laws and principles are stated in accordance with reference 8.4 Calculations on density and pressure are performed from derived formula 8.5 Concepts of pressure and density are applied in vehicle systems

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Mechanical systems may include but not limited to:	1.1 Pulleys 1.2 Levers 1.3 Wedge 1.4 Screws 1.5 Wheel and axle 1.6 Inclined plane
2. Principles may include but not limited to:	2.1 Newton's laws of motion 2.2 Law of conservation of

Variable	Range
	momentum 2.3 Law of conservation of energy 2.4 Archimedes' principle 2.5 Triangle of forces theorem 2.6 Parallelogram of forces law 2.7 Polygon of forces theorem 2.8 Principle of moments 2.9 Bow's notation 2.10 Gas laws
3. Calculations may include but not limited to:	3.1 Mechanical advantage 3.2 Velocity ratio 3.3 Efficiency 3.4 Torque 3.5 Power/Energy 3.6 Work 3.7 Quantity of heat 3.8 Velocity and acceleration 3.9 Stress and strain
4. Types of forces may include but not limited to:	4.1 Friction 4.2 Centrifugal 4.3 Centripetal 4.4 Gravitational 4.5 Inertia 4.6 Shear
5. Properties of materials may include but not limited to:	5.1 Elasticity 5.2 Tensile strength 5.3 Young modulus 5.4 Brittleness

Variable	Range
	5.5 Compressive strength 5.6 Shear strength 5.7 Plasticity 5.8 Modulus of rigidity
6. Parameters may include but not limited to:	6.1 Density 6.2 Temperature 6.3 Viscosity 6.4 Pressure
7. Power transmission systems may include but not limited to:	7.1 Pulleys 7.2 Clutches 7.3 Gears 7.4 Winches 7.5 Chains 7.6 Belts

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Apply basic automotive engineering formulas
- Use of basic mechanical machines
- Perform various unit conversions of engineering quantities
- Basic mechanical systems design
- simple machine operations
- Logical thinking
- Problem solving
- Drawing graphs
- Using different measuring tools

Required knowledge

The individual needs to demonstrate knowledge of:

- Newton's laws of motion
- Levers and pulleys
- Gear trains
- Laws of conservation of energy
- Laws of friction
- Types of forces
- Calculation of pressure and density
- Mechanical advantage and efficiency calculations
- Properties of materials
- Gas laws
- SI units of mechanical energy.
- Power transmission systems
- Operation of mechanical machines
- Mechanical calculation of power, energy, work done, torque and safety factor
- Units of measurement, conversions and abbreviations

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified Mechanical systems 1.2 Identified Principles of automotive science 1.3 Performed mechanical calculations of a system 1.4 Identified types of forces on a system

	1.5 Calculated resultant forces on plane framework 1.6 Identified application of forces on automotive systems 1.7 Tested mechanical properties of a materials 1.8 Identified tools and equipment for measuring system parameters 1.9 Recorded and interpreted measured parameters. 1.10 Operated Power transmission systems
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2 Measuring tools and equipment 2.3 Sample materials to be tested
3. Methods of Assessment	Competency in this unit may be assessed through: 1.1 Direct Observation 1.2 Demonstration with Oral Questioning 1.3 Case studies 1.4 Written tests
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.