-SQA-SCOTTISH QUALIFICATIONS AUTHORITY

HIGHER NATIONAL UNIT SPECIFICATION

GENERAL INFORMATION

Unit Number	**D3PV 04**
Unit Title	ENGINEERING PRINCIPLES (MECHANICAL)
Superclass Category	RC
Date of publication (month and year)	
Originating Centre for Unit	Cleveland Open Learning Unit

DESCRIPTION

Applying the principles of mechanical engineering.

OUTCOMES:

1. solve problems involving loaded beams;
2. solve problems involving thermal stresses;
3. solve problems involving power transmission;
4. apply dynamic principles to problems involving motion.
5. apply thermodynamic principles to simple fluid process problems.
6. solve problems involving forces due to liquid in motion.

CREDIT VALUE: 1 HN Credit

ACCESS STATEMENT:

Access to this unit is at the discretion of the centre. However, it would be beneficial if the student had competence Physics and Mathematics. Evidence of this competence could be the successful completion of modules in Engineering Science and Mathematics at National Certificate level or similar.

Additional copies of this unit can be obtained from: The Administrative Services Unit, SQA, Hanover House, 24 Douglas Street, Glasgow G2 7NQ (Tel: 0141-242 2166).

At the time of publication, the cost is £2.50 (minimum order £5.00)

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STATEMENT OF STANDARDS

Unit number:

Unit title: ENGINEERING PRINCIPLES (MECHANICAL)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the specification. All sections of the statement of the standards are mandatory and cannot be altered without reference to SQA.

OUTCOME

1. SOLVE PROBLEMS INVOLVING LOADED BEAMS

PERFORMANCE CRITERIA

(a) Conditions for equilibrium are stated.
(b) Shear force and bending moment values are correctly determined.
(c) Scaled shear force, bending moment and thrust diagrams are correctly constructed.
(d) The bending formula is applied correctly.
(e) Selection of an I-section beam from universal beam data is correct for the given loading.

RANGE STATEMENT

Loaded beams:	simply supported and cantilever beams carrying combined transverse point and uniformly distributed loads; hinged beams carrying combined distributed and angular loads.
Formula applications:	maximum bending stress; elastic modulus; universal beam data; radius of curvature.

EVIDENCE REQUIREMENTS

Written or oral evidence of the ability to state the conditions of equilibrium. Written and graphical evidence showing the ability to solve problems involving the beams and loading indicated in the range. Written evidence showing ability to use the bending formula to determine the properties listed in the range and to select an appropriate I-section beam from universal beam data.

OUTCOME

2. SOLVE PROBLEMS INVOLVING THERMAL STRESSES

PERFORMANCE CRITERIA

(a) Changes in length due to temperature change are correctly determined.

(b) The magnitude and nature of stresses due to temperature change are correctly determined.
(c) Accuracy of calculations is appropriate to the data provided.

RANGE STATEMENT

Temperature change:	increase; decrease.
Stress:	tensile stress; compressive stress.

EVIDENCE REQUIREMENTS

Written evidence showing the ability to determine changes in length induced by temperature change. Written evidence showing the ability to determine the stresses induced by temperature change subject to the restriction of linear expansion and contraction.

OUTCOME

3. SOLVE PROBLEMS INVOLVING POWER TRANSMISSION

PERFORMANCE CRITERIA

(a) The theory of torsion is applied to drive shafts.
(b) The magnitude and nature of stresses in drive shafts and couplings are determined.
(c) Solutions to problems relating transmitted power to vee belt dimensions are methodical and correct.

RANGE STATEMENT

Torsion theory:	polar second moment of area; torque; power transmitted; angle of twist.
Couplings:	coupling bolts; keys.

EVIDENCE REQUIREMENTS

Written evidence showing the ability to apply the theory of torsion involving the determination of the properties listed in the range. Written evidence showing the ability to determine stresses in drive shafts and couplings. Written evidence showing ability to relate transmitted power to vee belt dimensions.

OUTCOME

4. APPLY DYNAMIC PRINCIPLES TO PROBLEMS INVOLVING MOTION

PERFORMANCE CRITERIA

(a) The appropriate principles of linear and angular motion are correctly applied.
(b) Stages in the solution of mechanical system problems indicate a logical approach.

RANGE STATEMENT

Principles:	Force = mass × acceleration; Torque = moment of inertia × angular acceleration; conservation of momentum; kinetic energy; centripetal force.
Mechanical systems:	flat plate clutch; conical pendulum; simple centrifugal clutch; drum hoist (involving both linear and angular motion).

EVIDENCE REQUIREMENTS

Written evidence showing the ability to apply the appropriate dynamic principles to the solution of mechanical system problems as listed in the range.

OUTCOME

5. APPLY THERMODYNAMIC PRINCIPLES TO SIMPLE FLUID PROCESS PROBLEMS

PERFORMANCE CRITERIA

(a) Fluid properties are determined using property tables where necessary.
(b) The general energy equation for fluids is applied appropriately.
(c) The continuity equation is applied correctly.

RANGE STATEMENT

Fluid properties:	specific enthalpy of wet, dry saturated and superheated steam; dryness fraction; specific volume; specific density; use of interpolation.

EVIDENCE REQUIREMENTS

Written evidence showing the ability to determine fluid properties as listed in the range. Written evidence showing ability to apply the general energy equation to the solution of fluid problems involving changes in specific volume, a 'work done' quantity and an 'energy supplied' quantity. Written evidence showing ability to solve a 'tapered pipe' liquid flow problem involving the evaluation of all the terms of the Bernoulli equation.
Written evidence showing the ability to solve a liquid flow problem involving the use of the continuity equation.

OUTCOME

6. SOLVE PROBLEMS INVOLVING FORCES DUE TO LIQUID IN MOTION

PERFORMANCE CRITERIA

Continuation

(a) Forces due to liquid in motion are related to the rate of change of momentum of the liquid.
(b) Appropriate velocity vector diagrams are correctly constructed.
(c) Stages in the solution of problems indicate a logical approach.

RANGE STATEMENT

Forces:	impact of a jet; liquid motion in a pipe bend.

EVIDENCE REQUIREMENTS

Written and graphical evidence showing the ability to determine the force due to impact of a liquid jet.
Written and graphical evidence showing the ability to determine the force due to liquid motion in a pipe bend.

MERIT

To gain a pass in this unit, a candidate must meet the standards set out in the outcomes, performance criteria, range statements and evidence requirements.

To achieve a merit in this unit, a candidate must demonstrate a superior or more sophisticated level of performance. In this unit this might be shown in the following ways:

(a) Demonstrating an ability to relate theoretical principles to practical situations.

ASSESSMENT

In order to achieve this unit, candidates are required to present sufficient evidence that they have met all the performance criteria for each outcome within the range specified. Details of these requirements are given for each outcome. The assessment instruments used should follow the general guidance offered by the SQA assessment model and an integrative approach to assessment is encouraged. (See references at the end of support notes.)

Accurate records should be made of the assessment instruments used showing how evidence is generated for each outcome and giving marking schemes and/or checklists, etc. Records of candidates' achievements should be kept. These records will be available for external verification.

SPECIAL NEEDS

Proposals to modify outcomes, range statements or agreed assessment arrangements should be discussed in the first place with the external verifier.

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SUPPORT NOTES

Unit Number

Unit Title ENGINEERING PRINCIPLES (MECHANICAL)

SUPPORT NOTES:

This part of the unit specification is offered as guidance. None of the sections of the support notes is mandatory.

NOTIONAL DESIGN LENGTH:

SQA allocates a notional design length to a unit on the basis of time estimated for achievement of the stated standards by a candidate whose starting point is as described in the access statement. The notional design length for this unit is 40 hours. The use of notional design length for programme design and timetabling is advisory only.

REFERENCES

1. Guide to unit writing.
2. For a fuller discussion on assessment issues, please refer to SQA's Guide to Assessment.
3. Information for centres on SQA's operating procedures is contained in SQA's Guide to Procedures.
4. For details of other SQA publications, please consult SQA's publications list.