

# **Cambridge Technicals Engineering**

## **Unit 2C: Application of engineering principles**

Level 2 Cambridge Technical Certificate/Diploma in Engineering  
**05887 - 05888**

## **Mark Scheme for June 2022**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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| Question |     | Answer  | Marks    | Guidance  |
|----------|-----|---|----------|---|
| 1        | (a) | <p>The efficiency of the system is reduced because:<br/>E.g.<br/>The material of the pivot points creates heat as a result of friction [1].<br/>Noise from vibrations [1]<br/>Resulting from wear and tear on the pivots (1).<br/>Losses due to imbalances caused by friction or noise vibration (1).</p> <p style="text-align: right;">3 x 1 marks</p> | 3        | Only one of noise and vibrations  |
| 1        | (b) | <p>Efficiency = (output power/input power) x 100% [1]</p> <p style="text-align: center;">= (35/50) x 100% [1]</p> <p style="text-align: center;">= <b>70%</b> [1]</p>   | 3        | <p>Allow <b>70</b> or <b>70%</b>.</p> <p>Award full marks for correct answer with no working.</p> <p>0.7 scores 2 marks</p> |
| 1        | (c) | <p>Work done = force x distance [1]</p> <p style="text-align: center;">= 20 x 15 [1]</p> <p style="text-align: center;">= <b>300 Nm</b> [1]</p>   | 3        | <p>Allow <b>300</b> or <b>300 Nm</b>.</p> <p>Ignore units</p> <p>Award full marks for correct answer with no working</p>    |
|          |     |   | <b>9</b> |   |

| Question |     | Answer   | Marks  | Guidance  |
|----------|-----|--|--|---|
| 2        | (a) | <b>15 <math>\Omega</math> <math>\pm</math>10%</b><br>Correct value, 1 mark.<br>Correct tolerance, 1 mark.  | 2  | Allow <b>15</b> or <b>15 <math>\Omega</math></b> .<br>Allow <b>(<math>\pm</math>)1.5</b> or <b>(<math>\pm</math>) 10%</b> . Allow <b>10% of their value</b> .   |
| 2        | (b) | Control of current, 1 mark.<br>Control of voltage, 1 mark.   | 2  | Allow to protect components instead of control current  |
| 2        | (c) | Polarised:<br><br>Larger values<br>Power supply smoothing<br>Filtering<br><br>Non-polarised :<br><br>Smaller values<br>Signal coupling<br>Tuning circuit | 2 x 1<br><br><br><br><br><br><br><br><br><br><br><br>2 x 1 | Allow<br>E.g.<br>Storage of energy<br>To send low frequency signals<br>Noise filter<br>Coupling amplifier stages<br>Decoupling power supplies<br>Voltage regulation<br><br>E.g.<br>Feedback circuits<br>Power factor correction<br>Radio frequency circuits<br>Compensation<br>Oscillation circuits |
| 2        | (d) | <b>Double pole (1) double throw (1) switch</b> , 2 x 1 marks<br><br><b>Single pole (1) single throw (1) switch</b> , 2 x 1 marks                         | 4  | Allow dpdt for 2 marks<br><br>Allow spst for 2 marks<br><br>If double <u>and</u> single seen in respective responses award 1 mark   |
|          |     |  | <b>12</b>  |   |

| Question |     | Answer   | Marks     | Guidance   |
|----------|-----|--|-----------|--|
| 3        | (a) | <p>Cast Iron – Toughness (or allow high weight/ density)</p> <p>ABS - Machinability or toughness</p> <p>Phenol-formaldehyde - Heat resistant (or allow <u>low</u> heat conductivity)</p> <p>Urea-formaldehyde - Low conductivity (of electricity)</p> <p>Tungsten carbide - Hardness</p> <p>Carbon fibre - Strength or low weight/ density</p> <p style="text-align: right;">6 x 1 marks</p>   | 6         |  |
| 3        | (b) | <p>Riveting is a permanent process using metal rivets with preformed heads [1].<br/>The rivet joins parts together by passing through a hole and holding each part together when the end of the rivet is formed over the connection to hold the rivet in place thus joining the parts securely [1], 2 x 1 marks</p> <p>Welding is a fabrication process that joins materials together [1] by using high heat to melt the parts together and allowing them to cool, causing fusion [1]. A filler metal of the same type as the parent metals is normally used [1] 2 x 1 marks.</p> <p>Adhesive Bonding is the process of joining two surfaces together to create a smooth bond [1].<br/>The adhesive can be a glue or epoxy resin or a plastic agent [1], 2 x 1 marks</p> | 6         | <p>Allow other valid stages for each process.</p> <p>For 2 marks answer must be convincing and include reference to hole, pre-formed head and forming of end (of rivet).</p> <p>For 2 marks must include reference to filler metal normally used.</p> <p>For 2 marks must include reference to surfaces.</p> |
|          |     |  | <b>12</b> |  |

| Question |     | Answer   | Marks | Guidance   |
|----------|-----|--|-------|--|
| 4        | (a) | <p><b>Single acting cylinder</b><br/>Compressed air flows through the entrance opening to come into contact with the piston [1].<br/>Thrust is therefore produced in one direction. The return of the piston is provided by the internal spring which is around the piston rod [1].</p> <p><b>Double acting cylinder</b><br/>Air pressure is applied from either end of the cylinder to the surface of the piston, producing a propelling force, to outstroke the piston and an opposition force to instroke it. [1].<br/>The thrust produced during retraction is weaker because the force operates over a greater surface area due to the space taken up by the rod of the piston on the outstroke. [1].</p> | 4     | <p>Single acting cylinder<br/>1 mark for each valid point.<br/>Allow 2 marks for a full explanation of a single point.</p> <p>Double acting cylinder.<br/>1 mark for each valid point.<br/>Allow 2 marks for a full explanation of a single point.</p> |
|          | (b) | <p>LSAC<br/>Car Hoist<br/>Car Jack</p> <p>LDAC<br/>Robot Arm<br/>Excavator bucket arm</p>  | 2     | <p>Allow</p> <p><b>Linear single Acting Cylinder</b><br/>E.g.<br/>Clamping<br/>Positioning<br/>Punching</p> <p><b>Linear double Acting Cylinder</b><br/>E.g.<br/>Opening &amp; closing doors<br/>Rubbish compactors<br/>Crushing old cars</p>          |
|          | (c) | Hydraulic pump displacement is the amount of liquid transferred from a pump inlet [1] to its outlet [1] in one cycle [1].  | 3     | <p>1 mark for each valid point.<br/>Allow 2 marks for full explanation of a single point.<br/>Allow max 1 mark for reasonable reference to flow<br/>WITHIN POWER SOURCE.</p>   |

| Question |     | Answer  | Marks     | Guidance |
|----------|-----|---|-----------|----------|
|          | (d) | <p>Spool valve</p> <p>Check valve (allow non-return or one way)</p> <p>Rotary valve</p> <p style="text-align: right;">3 x 1 marks</p> | 3         |          |
|          |     |   | <b>12</b> |          |

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