

**Qualification: 0171-018/518 Level 3 Land-Based Engineering - Theory exam (2)**
  
**March 2019**

<p>1</p>	<p>           a) What type of gear is shown in Figure 1? (1 mark)            b) What type of load does the gear shown in Figure 1 exhibit? (1 mark)            c) State <b>three</b> disadvantages of the gear shown in Figure 1. (3 marks)         </p> <div> </div> <p style="text-align: center;">Figure 1</p>		
	<p><b>Acceptable answer(s)</b></p> <p>           a) 1 mark for stating spur or straight cut.            b) 1 mark for stating radial load.            c) 1 mark for each of the following up to 3 marks           <ul style="list-style-type: none"> <li>• Spur gears produce a lot of noise when operating at high speeds.</li> <li>• They cannot be used for long distance power transmission.</li> <li>• Gear teeth experience a large amount of stress.</li> </ul> </p>	<p><b>Guidance</b></p> <p>Accept any other suitable answer</p>	<p><b>Max mks</b></p> <p>5</p>
<p>2</p>	<p>           a) What type of chain is shown in Figure 2?             b) Describe <b>three</b> benefits of the chain shown in Figure 2.         </p>		<p>(1 mark)</p>

(3 marks)



<https://dir.indiamart.com>

**Figure 2**

**Acceptable answer(s)**

**Guidance**

**Max  
mks**

- a) 1 mark for stating crank link chain.  
b) 1 mark for identifying each of the following up to 3 marks.
- High load carrying capability
  - High resistance to wear
  - Ability to absorb excessive shock loading

Accept any other suitable answer

4

3

a) What belt would be used in conjunction with the pulley in Figure 3? (1 mark)

b) Identify **one** maintenance check that should be carried out on this type of belt in a transmission system. (1 mark)



<http://www.lockingdevice.net>

**Figure 3**

	<b>Acceptable answer(s)</b>	<b>Guidance</b>	<b>Max mks</b>
	a) 1 mark for stating multi vee belt. b) 1 mark for stating visual (cracking or fraying), belt tension or angle alignment.	Accept any other suitable answer	2
4	Describe <b>four</b> symptoms of incorrectly adjusted bearing pre-load on a transmission system. (4 marks)		
	<b>Acceptable answer(s)</b>	<b>Guidance</b>	<b>Max mks</b>
	1 mark for each of the following up to 4 marks: <ul style="list-style-type: none"> <li>• Excessive noise</li> <li>• Excessive vibration</li> <li>• Excessive heat</li> <li>• Excessive bearing wear</li> </ul>	Accept any other suitable answer	4
5	State the <b>four</b> components that make up an epicyclic unit found in a tractor final drive system. (4 marks)		
	<b>Acceptable answer(s)</b>	<b>Guidance</b>	<b>Max mks</b>
	1 mark for each of the following up to 4 marks: <ul style="list-style-type: none"> <li>• Planet gears</li> <li>• Sun gears</li> <li>• Ring gear/annulus</li> <li>• Planet carrier</li> </ul>		4
6	a) If a single plate dry clutch is experiencing slipping when driving, what are <b>five most</b> likely causes? (5 marks)		

	<p>b) A single plate dry clutch exhibits a rumbling sound when engaged. Describe <b>two most</b> likely causes. (2 marks)</p>		
	<b>Acceptable answer(s)</b>	<b>Guidance</b>	<b>Max mks</b>
	<p>a) 1 mark for each of the following up to 5 marks.</p> <ul style="list-style-type: none"> <li>• Worn Clutch Disc</li> <li>• Oil soaked Disc</li> <li>• Clutch out of adjustment</li> <li>• Binding Linkage</li> <li>• Defective pressure plate</li> <li>• Excessively worn fly wheel friction face</li> <li>• Excessively worn pressure plate</li> </ul> <p>b) 1 mark for the following up to 2 marks.</p> <ul style="list-style-type: none"> <li>• Worn release bearing.</li> <li>• Clutch out of alignment</li> </ul>	Accept any other suitable answer	7
7	<p>In a single plate clutch, describe <b>four</b> advantages of a spring disc hub compared to a rigid disc hub. (4 marks)</p>		
	<b>Acceptable answer(s)</b>	<b>Guidance</b>	<b>Max mks</b>
	<p>1 mark for each of the following up to 4 marks:</p> <ul style="list-style-type: none"> <li>• To absorb torsional shock loadings during clutch take up.</li> <li>• Quieter operation, reduces different types of gear noise.</li> <li>• Less wear, providing longer spline life of the clutch disc.</li> <li>• Less wear on the friction lining during clutch engagement/disengagement</li> </ul>	Any other appropriate response.	4
8	<p>Describe <b>five</b> advantages of a continuously variable transmission (CVT). (5 marks)</p>		
	<b>Acceptable answer(s)</b>	<b>Guidance</b>	<b>Max mks</b>
	<p>1 mark for each of the following up to 5 marks:</p> <ul style="list-style-type: none"> <li>• Allows the engine to operate at maximum efficiency at all times.</li> </ul>	Accept any other suitable answer	5

	<ul style="list-style-type: none"> <li>• Provides a greater range of speeds compared to the fixed ratios of other transmissions</li> <li>• Provides a greater range of torque compared to the fixed ratios of other transmissions</li> <li>• Reduces exhaust emissions due to lower engine input speeds.</li> <li>• Provides a constant drive irrespective of engine rpm.</li> </ul>		
9	Describe the function of <b>seven</b> hydraulic components found in a hydrostatic transmission system.  (7 marks)		
	<b>Acceptable answer(s)</b>	<b>Guidance</b>	<b>Max mks</b>
	1 mark for each of the following up to 7 marks: <ul style="list-style-type: none"> <li>• Variable displacement hydraulic pump generates flow to the motor to create drive.</li> <li>• Fixed/variable displacement hydraulic motor receives flow from the hydraulic pump to generate drive.</li> <li>• Pressure relief valve relieves excessive hydraulic pressure within the system.</li> <li>• Charge pump charge the closed loop system with hydraulic oil.</li> <li>• Motor loop flush increases cooling efficiency within the closed loop system.</li> <li>• Hydraulic filter filter micronic contaminants</li> <li>• Check valves one way directional valve used to protect the charge circuit.</li> </ul>	Accept any other suitable answer	7
10	A large gear is driving a small gear. The large gear rotates at 165 rpm and the small gear rotates at 330 rpm. What is the gear ratio between the two gears?  (2 marks)		
	<b>Acceptable answer(s)</b>	<b>Guidance</b>	<b>Max mks</b>

	1 mark for stating 1:2 and 1 mark for showing correct working up to 2 marks		2
11	State <b>four</b> main components found in a tractor CVT transmission system.  (4 marks)		
	<b>Acceptable answer(s)</b>	<b>Guidance</b>	<b>Max mks</b>
	1 mark for each of the following up to 4 marks: <ul style="list-style-type: none"> <li>• Multiplate clutch packs.</li> <li>• Synchronisers.</li> <li>• Hydrostat.</li> <li>• Epicyclic unit/planetary gear set.</li> <li>• Gears</li> <li>• Transmission ECU</li> <li>• Controls</li> </ul>	Accept any other suitable answer	4
12	A combine harvester with a hydrostatic transmission system has lost drive in forward and reverse. Discuss the preparation stages, resources and steps required to carry out a full diagnostic assessment.  (12 marks)		
	<b>Acceptable answer(s)</b>	<b>Guidance</b>	<b>Max mks</b>
	<p><b>Band 1 (1-4 marks)</b> The candidate has failed to propose many of the appropriate preparation, resources and steps required. The candidate has provided minimal rationale as to why they have proposed any preparation, resources and steps required. The candidate's response may have frequently strayed from focusing on the relevant transmission system and components. The candidate will not have suggested any expected outcomes of their proposed diagnostic steps.</p> <p><b>Band 2 (5-8 marks)</b> The candidate has proposed some appropriate preparation, resources and steps required, in a mostly workable sequence. The candidate has occasionally provided reasons why they have proposed the preparation, resources and steps required. The candidate has largely focused on the relevant transmission systems and components, but may have strayed into discussing irrelevant components. The candidate is unlikely to have</p>	<p><b>Indicative content</b> 1 mark for each of the following up to 12 marks:</p> <ul style="list-style-type: none"> <li>• Discuss symptoms of the fault with the operator</li> <li>• Operate the combine harvester</li> <li>• Check hydraulic oil level</li> <li>• Change/check hydraulic oil filters</li> <li>• Check for error codes</li> <li>• Check electrical solenoids for correct operation</li> <li>• Check technical documentation and schematic diagrams</li> </ul>	12

	<p>suggested expected outcomes of their proposed diagnostic steps.</p> <p><b>Band 3 (9-12 marks)</b></p> <p>The candidate has proposed a broad range of appropriate preparation, resources and steps required, and in a logical sequence. The candidate has provided clear reasons why they have proposed the preparation, resources and steps required. The candidate has remained focused on the relevant transmission systems and components. The candidate has (where applicable) suggested expected outcomes of their proposed diagnostic steps.</p>	<ul style="list-style-type: none"> <li>• Check pressure testing equipment for correct calibration</li> <li>• Conduct charge system pressure test</li> <li>• Conduct hydraulic pressure test for forward and reverse</li> <li>• Conduct flow test of the hydrostatic pump</li> <li>• Check flow through the hydrostatic motor.</li> </ul>	
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