



Province of the  
**EASTERN CAPE**  
EDUCATION

**DIRECTORATE SENIOR CURRICULUM MANAGEMENT (SEN-FET)**

**HOME SCHOOLING SELF-STUDY WORKSHEET ANSWER SHEET**

<b>SUBJECT</b>	FITTING AND MACHINING	<b>GRADE</b>	12	<b>DATE</b>	JULY 2020
<b>TOPIC</b>	SYSTEMS AND CONTROL (DRIVE SYSTEMS) (SPECIFIC)	<b>TERM 1 REVISION</b>	(Please tick)	<b>TERM 3 CONTENT</b>	(✓)

**QUESTION 1**

1.1 Advantages of a belt drive:

- Needs no lubrication
- Silent operation
- Cheaper parts
- Can change direction without additional
- Easy to replace
- Transmit power over a longer distance

1.2 **Principle of operation of a gear drive.**

Gear drives work on the principle that the turning motion of one gear be transferred to another gear if the gears are mounted close so that they mesh or engage.

### QUESTION 2 Hydraulic system:

2.1 Calculate the Force applied on Piston A.

$$d_a = 28 \text{ mm}; D_b = 148 \text{ mm}; X_a = 80 \text{ mm}; X_b = ?$$

$$P = \frac{F}{A}$$

$$A = \pi D_a^2 / 4 \checkmark$$

$$= \pi (0,028)^2 / 4 \checkmark$$

$$= \underline{6,158 \times 10^{-4} \text{ m}^2} \checkmark$$

$$F = P \times A$$

$$= 0,4 \times 10^6 \times 6,158 \times 10^{-4} \checkmark$$

$$\text{Force} = 246,3 \text{ N} \checkmark$$

2.2 Volume displaced in the system:

$$\text{Vol}@_a = \text{Vol}@_b \checkmark$$

$$A_a \times S_{La} = A_b \times S_{Lb} \checkmark$$

$$\pi D_a^2 / 4 \times 80 = \pi D_b^2 / 4 \times S_{Lb} \checkmark \checkmark$$

$$S_{Lb} = 2,86 \text{ mm} \checkmark \checkmark$$

**QUESTION 3** Hydraulic system:

$$A = \frac{\pi D^2}{4}$$
$$= \frac{\pi(0,12)^2}{4}$$
$$A = 11,31 \times 10^{-3} \text{ m}^2$$

$$p = \frac{F}{A}$$

$$F = p \times A$$

$$F = (1,2 \times 10^6) \times (11,31 \times 10^{-3})$$

$$F = 13572 \text{ N}$$

$$F = 13,57 \text{ kN}$$

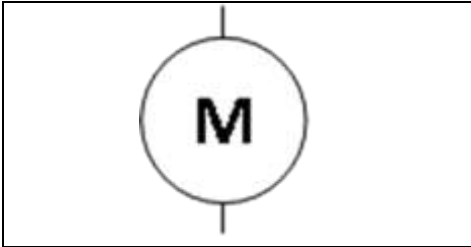
**QUESTION 4** Functions of a reservoir in a hydraulic system:

- A fluid storage tank.
- Promotes air separation from the fluid.
- Supports for the pump and electric motor
- Promotes heat dispersion
- Acts as a base plate for mounting control equipment.

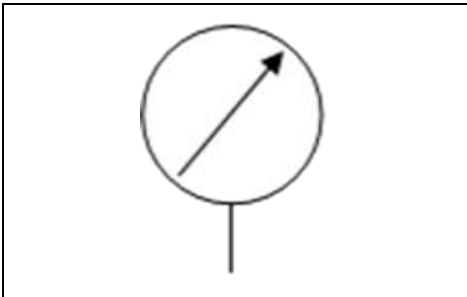
(ANY 2)

**QUESTION 5** Hydraulic symbols:

5.1 Electrical motor:



5.2 Pressure gauge:



**QUESTION 6** Belt drive calculations:

$$N_{\text{motor}} \times D_{\text{motor}} = N_{\text{blade}} \times D_{\text{blade}} \quad \checkmark$$

$$125 \times 1100 = 375 \times D_{\text{blade}} \quad \checkmark$$

$$D_{\text{blade}} = 366,667 \text{ rpm} \quad \checkmark$$

## QUESTION 7 Belt-drive system:

7.1 Belt speed (v):

$$\begin{aligned} v &= \frac{\pi DN}{1000 \times 60} \\ &= \frac{\pi \times 230 \times 1440}{1000 \times 60} \\ v &= 17,34 \text{ m.s}^{-1} \end{aligned}$$

7.2 Power transmitted (p):

$$\begin{aligned} P &= (T_1 - T_2)v \\ &= 165 \times 17,34 \\ P &= 2861,10 \text{ Watt} \\ P &= 2,86 \text{ kW} \end{aligned}$$

7.3 Advantages of belt drives

- They produce less noise and vibrations
- They do not require parallel shafts
- They are simple and cheaper to install compare to other drives
- They do not need lubrication
- Belt drives are very efficient.

**QUESTION 8** Gear drive system:

8.1 Driven gear C will rotate in the same direction (clockwise)

8.2 Number of teeth on gear C:

$$\begin{aligned}T_C \times N_C &= T_A \times N_A \\T_C &= \frac{T_A \times N_A}{N_C} \\&= \frac{102 \times 120}{80} \\T_C &= 153 \text{ teeth}\end{aligned}$$

8.3 Idler gear is used to change direction of rotation.

**QUESTION 9** Compound Gear calculations:

9.1

$$\begin{aligned}\frac{N_{output}}{N_{motor}} &= \frac{T_i 24 \times T_i 20 \times T_i 42}{T_v 40 \times T_v 48 \times T_v 90} \checkmark \\N &= \frac{24 \times 20 \times 42}{40 \times 48 \times 90} \times 1440 \quad \checkmark \checkmark \\N_{output} &= 168 \text{ rpm} \quad \checkmark\end{aligned}$$

9.2

$$VR = \frac{N_{driver}}{N_{final}} \checkmark$$

$$VR = 1440/168 \checkmark$$

$$VR = 60 : 7 \checkmark$$

QUESTION 10 Derivation of Units:

$$\begin{aligned} \text{Torque} &= \text{Force (F)} \times \text{Radius (r)} \\ &= (\text{N}) \times (\text{m}) \\ &= \text{N.m} \checkmark \end{aligned}$$

**QUESTION 11** Chain drive system:

**Gear ratio:**

$$\begin{aligned} \text{GR} &= \frac{T_{\text{dr}}}{T_{\text{dn}}} \\ &= \frac{48}{32} \\ \text{GR} &= 1:1,5 \end{aligned}$$

**OR**

$$\begin{aligned} \text{GR} &= \frac{T_{\text{dn}}}{T_{\text{dr}}} \\ &= \frac{32}{48} \\ \text{GR} &= 1:0,67 \end{aligned}$$