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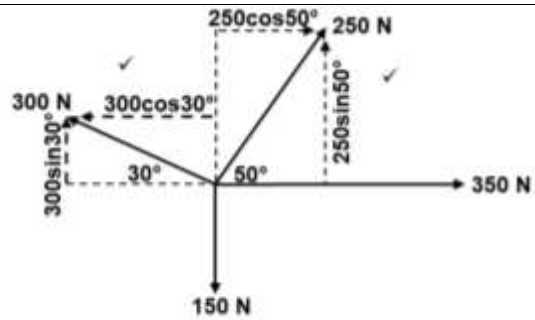
DIRECTORATE SENIOR CURRICULUM MANAGEMENT (SEN-FET)

HOME SCHOOLING SELF-STUDY WORKSHEET ANSWER SHEET

SUBJECT	FITTING & MACHINING	GRADE	12	DATE	JUNE 2020
TOPIC	FORCES & MAINTENANCE SPECIFIC	TERM 1 REVISION	(Please tick)	TERM 2 CONTENT	(√)

QUESTION 1 FORCES:

1.1 Resultant:



$$\begin{aligned} \Sigma HC &= 350 + 250\cos 50^\circ - 300\cos 30^\circ \\ &= 350 + 160,97 - 259,81 \\ &= 251,16 \text{ N} \end{aligned}$$

$$\begin{aligned} \Sigma VC &= 300\sin 30^\circ + 250\sin 50^\circ - 150 \\ &= 150 + 191,51 - 150 \\ &= 191,51 \text{ N} \end{aligned}$$

OR

Horizontal components	Magnitudes	Vertical components	Magnitudes
-300Cos30°	-259,81 N ✓	300Sin30°	150 N ✓
250Cos50°	160,97 N ✓	250Sin50°	191,51 N ✓
350	350 N	-150	-150 N
TOTAL	251,16 N ✓	TOTAL	191,51 N ✓

$$R^2 = HC^2 + VC^2$$

$$R = \sqrt{251,16^2 + 191,51^2}$$

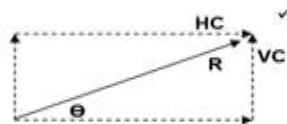
$$R = 315,84 \text{ N} \quad \checkmark$$

$$\tan \theta = \frac{VC}{HC}$$

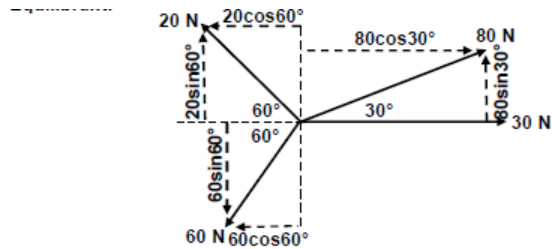
$$= \frac{191,51}{251,16}$$

$$\theta = 37,33^\circ \quad \checkmark$$

$$R = 315,84 \text{ N at } 37,33^\circ \text{ north from east}$$



1.2 Equilibrant:



$$\begin{aligned}\Sigma HC &= 30 + 80\cos 30^\circ - 20\cos 60^\circ - 60\cos 60^\circ \\ &= 30 + 69,28 - 10 - 30 \\ &= 59,28 \text{ N} \checkmark\end{aligned}$$

$$\begin{aligned}\Sigma VC &= 20\sin 60^\circ + 80\sin 30^\circ - 60\sin 60^\circ \\ &= 17,32 + 40 - 51,96 \\ &= 5,36 \text{ N} \checkmark\end{aligned}$$

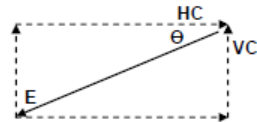
OR

HC	Magnitudes	VC	Magnitudes
30	30 ✓	20sin60°	17,32 ✓
80cos30°	69,28 ✓	80sin30°	40 ✓
-20cos60°	-10 ✓	-60sin60°	-51,96 ✓
-60cos60°	-30 ✓		
TOTAL	59,28 N ✓	TOTAL	5,36 N ✓

$$E^2 = HC^2 + VC^2$$

$$E = \sqrt{59,28^2 + 5,36^2} \checkmark$$

$$E = 59,52 \text{ N} \checkmark$$



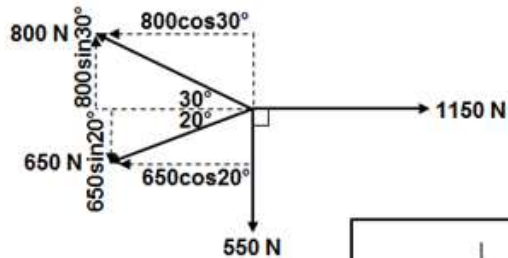
$$\text{Tan}\theta = \frac{VC}{HC}$$

$$= \frac{5,36}{59,28} \checkmark$$

$$\theta = 5,17^\circ \checkmark$$

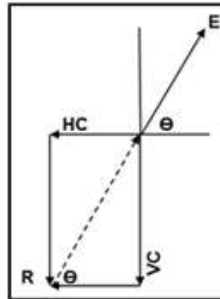
$E = 59,52 \text{ N}$ at $5,17^\circ$ (South from West) or
 $E = 59,52 \text{ N}$ at $84,83^\circ$ (West from South) or
 $E = 59,52 \text{ N}$ at a bearing of $264,83^\circ$

1.3 Forces:



✓
 $HC = 1150 - 800\cos30^\circ - 650\cos20^\circ$
 $= 1150 \checkmark - 692,82 \checkmark - 610,80 \checkmark$
 $= -153,62 \text{ N} \checkmark$

✓
 $VC = 800\sin30^\circ - 650\sin20^\circ - 550$
 $= 400 \checkmark - 222,31 \checkmark - 550 \checkmark$
 $= -372,31 \text{ N} \checkmark$



Horizontal components ✓	Magnitudes	Vertical components ✓	Magnitudes
1150	1150 N ✓	$800\sin30^\circ$	400 N ✓
$-800\cos30^\circ$	-692,82 N ✓	$-650\sin20^\circ$	- 222,31 N ✓
$-650\cos20^\circ$	-610,80 N ✓	-550	-550 N ✓
TOTAL	-153,62 N ✓	TOTAL	-372,31 N ✓

$E^2 = HC^2 + VC^2 \checkmark$

$\sqrt{E^2} = \sqrt{153,62^2 + 372,31^2}$

$E = 402,76 \text{ N} \checkmark$

$\tan \theta = \frac{VC}{HC} \checkmark$

$= \frac{372,31}{153,62}$

$\theta = 67,58^\circ \checkmark$

Equilibrant = 402,76 N en $67,58^\circ$ North from East ✓

Horizontal Components	Magnitudes	Vertical Components	Magnitudes
$1150\cos 0^\circ$	1150N	$1150\sin 0^\circ$	0N
$800\cos 150^\circ$	-692,82N	$800\sin 150^\circ$	400N
$650\cos 200^\circ$	-610,80N	$650\sin 200^\circ$	-222,31N
$550\cos 270^\circ$	0N	$550\sin 270^\circ$	-550N
TOTAL:	-153,62N	TOTAL:	-372,31N

QUESTION 2

2.1 Preventative maintenance:

- Risk of injury or death
- Financial loss due to damage suffered as a result of part failure
- Loss of valuable production time

2.2 Malfunctioning of chain drives:

- Lack of lubrication
- Sprockets not properly secured to shafts
- Incorrect sprocket alignment
- Overloading
- Incorrect tension

(ANY 2)

2.3 Wear on a belt drive system:

- Check for wear and tear
- Check belt/pulley alignment
- Check tension setting
- Check tensioning devices, e.g. jockeys

(ANY 2)

2.4 Replace the belt on a belt drive system:

- Release the tension on the belt and remove from pulleys
- Check the condition and alignment of the pulleys
- Fit the new specified belt
- Apply adequate tension to the belt
- Check for proper operation

2.5 Materials:

2.5.1 Polyvinyl chloride (PVC):

- It is a thermoplastic composite
- Flexible
- Gives a dull sound
- It is a tough material
- It can be welded or bonded with an adhesive
- Good electrical insulation

(ANY 1)

2.5.2 Carbon fibre:

- It is a thermo hardened (thermosetting) composite
- It is a strong and tough material
- It is a light weight material
- It is water resistant
- It is UV resistant
- It is a good electrical insulation

(ANY 1)

2.6 Thermoplastic or Thermo hardened composites:

2.6.1 Teflon:

Thermoplastic

2.6.2 **Vesconite:**

Thermoplastic

2.6.3 Bakelite:

Thermo hardened

2.7 **Coefficient of friction:**

Thermo composites

QUESTION 3

3.1 Types of maintenance:

- Preventative.
- Predictive.
- Reliable centred.

3.2 Malfunctioning of belt drives:

- Lubrication between belt and pulley causing belt slip.
- Pulleys not properly secured to shafts.
- Incorrect pulley alignment.
- Overloading the system.
- Incorrect belt tension.
- Worn belts.
- Faulty/damaged tensioner pulley.
- Lack of maintenance.

(ANY 2)

3.3 Replace the chain on a chain drive system:

- Release the tension on the chain and remove from sprocket.
- Check the condition and alignment of the sprockets.
- Fit the new specified chain and lubricate.
- Apply adequate tension to the chain.
- Check for proper operation.

3.4 Wear on a gear drive system:

- Check and replenish of lubrication levels.
- Ensuring the gears are properly secured to shafts.
- Cleaning and replacement of oil filters.
- Reporting excessive noise, wear, vibration and overheating for expert attention.

(ANY 2)

3.5 Material:

3.5.1 Nylon:

- Bushes
- Gears
- Pulleys
- Fishing line
- Clothing
- Sails
- Ropes
- Sport equipment
- Powder coating

(ANY 1)

3.5.2 **Glass fibre:**

- Used in boats
- Motor vehicle bodies
- Transparent roof sheets
- Petrol tanks
- Swimming pools
- Furniture
- Fruit and salad bowls
- Ornaments
- Fishing rods
- Sporting equipment.

(ANY 1)

3.6 Thermoplastic or Thermo hardened composites:

3.6.1 **Teflon:**

Thermoplastic

3.6.2 **Bakelite:**

Thermo hardened / Thermo setting.

3.7 Coefficient of friction:

- Contact pressure
- Surface roughness
- Temperature
- Sliding velocity
- Type (amount) of lubricant
- Type of material.

(ANY 2)

QUESTION 4

4.1 Lack of preventative maintenance:

- Risk of injury or death.
- Financial loss due to damage suffered as a result of part failure and the waste of material.
- Loss of valuable production time.

4.2 Causes for the malfunctioning of chain drive systems:

- Lack of or incorrect lubrication
- Lack of maintenance
- Overloading
- Misalignment of sprockets
- Incorrect chain tension
- Contamination of chain drive system such as dust or sand. (ANY 2)

4.3 Procedures to reduce the physical wear on a belt drive system:

- Check the belt alignment.
- Checking the belt tension.
- Prevent overloading of the system.
- Keep the pulleys and belt clean.
- Check that all covers are secure. (ANY 2)

4.4 Procedures to replace the belt on a belt drive system:

- Ensure that the machine is switched off.
- Release the tension on the belt.
- Remove the belt from the pulleys.
- Fit the correct size replacement belt onto the pulleys.

- Check the pulley alignment.
- Apply adequate tension according to specification and lock the system. (ANY 5)

4.5 Properties of materials:

4.5.1 Poly vinyl chloride (PVC):

- Flexible.
- Rubber-like substance.
- Makes a dull sound when dropped.
- Tough.
- Act as an insulator.
- It is durable.
- Highly resistant to oxidative material.
- Oil, water and chemical resistant. (ANY 1)

4.5.2 Carbon fibre:

- Strong.
- Tough.
- Light weight.
- Good electrical conductor. (ANY 1)

4.6 Difference between “Thermoplastic” and “Thermo hardened (thermosetting)” composites:

- Thermoplastics can be reheated and deformed. / Recyclable.
- Thermo hardened cannot be reheated. / Non-recyclable.

4.7 Examples of thermo hardened composites:

- Carbon fibre or (Any application).
- Glass fibre or (Any application).

- Bakelite or (Any application).
- Teflon or (Any application).

(ANY 2)