higher education
& training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T650(**E**)(J31)T

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

(11022032)

31 July 2017 (X-Paper)
09:00–12:00

This question paper consists of 9 pages and 1 formula sheet.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
FITTING AND MACHINING THEORY N2
TIME: 3 HOURS
MARKS: 100

NOTE: If you answer more than the required number of questions, only the required number of questions will be marked. All work you do not want to be marked, must be clearly crossed out.

INSTRUCTIONS AND INFORMATION

1.   Answer ALL the questions in SECTION A, except for QUESTION 1 where you must answer either QUESTION 1.1 OR QUESTION 1.2.

2.   Answer only TWO questions in SECTION B.

3.   Read ALL the questions carefully.

4.   Number the answers according to the numbering system used in this question paper.

5.   Write neatly and legibly.

SECTION A

QUESTION 1: OCCUPATIONAL SAFETY

NOTE: Answer ONLY QUESTION 1.1 OR QUESTION 1.2.

1.1 List FIVE items of technical information that should be stated on the manufacturer's plate and safety devices of pressure vessels. **[5]**

OR

1.2 List FIVE items of 'contraband' which are not allowed in the underground workings of a mine. **[5]**

QUESTION 2: COUPLINGS

2.1 State the difference between a *coupling* and a *clutch*. (2)

2.2 Complete the TABLE below on the different groups and types of couplings. Write only the answer next to the question number (2.2.1 – 2.2.4) in the ANSWER BOOK.

GROUP OF COUPLING	TYPE OF COUPLING
2.2.1	Chain coupling
Self-aligning coupling	**2.2.2**
2.2.3	Spider coupling
2.2.4	Metal disc coupling

(4 × 1) (4)
[6]

QUESTION 3: LIMITS AND FITS

FIGURE 1 shows the dimensions to which a shaft and a bush must be machined.
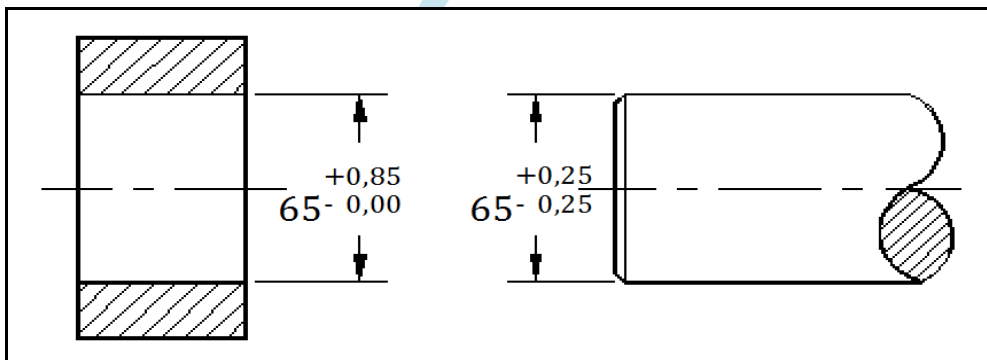
FIGURE 1

Determine the following:

3.1   The high limit of the shaft

3.2   The high limit of the bush

3.3   The low limit of the shaft

3.4   The low limit of the bush

3.5   The tolerance of the shaft

3.6   The maximum allowance of the fitted parts

3.7   The minimum allowance of the fitted parts

                                                          (7 × 1)   **[7]**

QUESTION 4: BEARINGS

4.1   List THREE methods of mounting an antifriction bearing onto a shaft.   (3)

4.2   The type of contact between plain bearings and between roller bearings is important in the operation of a bearing.

        Name the type of contact in the case of the following:

        4.2.1   Plain bearings

        4.2.2   Roller bearings

                                                          (2 × 1)   (2)
                                                                       [5]

QUESTION 5 : LUBRICATION AND VALVES

5.1   Name THREE commonly used solid lubricants.   (3)

5.2   Indicate whether the following statements are TRUE or FALSE. Choose the
        answer and write only 'true' or 'false' next to the question number
        (5.2.1 – 5.2.3) in the ANSWER BOOK.

        5.2.1   A check valve prevents liquid from flowing backwards.

        5.2.2   Pressure relief valves stay open all the time to allow fluid to return
                  to the tank, thus preventing damage to the system.

        5.2.3   A foot valve allows the flow of liquids in both directions.
                                                                        (3 × 1)   (3)
   **[6]**

QUESTION 6: PACKING, STUFFING BOXES, JOINTS AND WATER-PIPE SYSTEMS

6.1   Complete the following sentences on how a lantern ring works by writing
        down the missing word or words. Write only the word or words next to the
        question number (6.1.1 – 6.1.3) in the ANSWER BOOK.

        The lantern ring is a steel ring which has a series of (6.1.1)… around its
        circumference. Water is piped to provide a (6.1.2) … around the shaft to seal
        the shaft against air entering from outside. This assists to maintain a (6.1.3)…
        condition in the pump.   (3)

6.2   Name THREE factors to be taken into consideration before selecting a
        jointing material to be used on pipe joints.   (3)

6.3   FIGURE 2 below shows THREE types of pipe fittings. State the function of
        each of the fittings shown. Write only the answer next to the question number
        (6.3.1 – 6.3.3) in the ANSWER BOOK.

6.3.1	6.3.2	6.3.3
REDUCER	CAP	T-PIECE

FIGURE 2   (3)
                                                                                     [9]

QUESTION 7: PUMPS

FIGURE 3 below shows a sketch of a centrifugal pump.
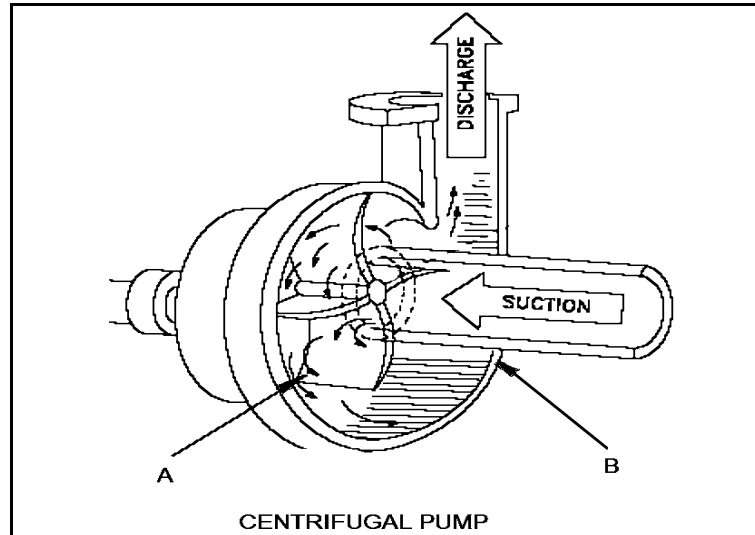
FIGURE 3

7.1   Name the parts labelled A and B in the above sketch. Write only the name of
        the part next to the letter (A – B) in the ANSWER BOOK.   (2)

7.2   Explain the main difference between a piston pump and a plunger pump   (2)

7.3   State TWO differences between a single acting reciprocating pump and a
        double acting reciprocating pump.   (2)

        [6]

QUESTION 8: COMPRESSORS

8.1   State THREE routine tasks that are applicable when performing maintenance
        on a compressor.   (3)

8.2   Name the device, fitted to air receivers of compressors, which prevents the air
        receiver from bursting under excessive pressure.   (1)

        [4]

QUESTION 9: V-BELTS, CHAIN DRIVES, GEAR DRIVES AND REDUCTION GEARBOXES

9.1   State THREE disadvantages of V-belts compared to chain drives.   (3)

9.2   Distinguish between a *simple gear train* and a *complex gear train.*   (2)

9.3   List THREE reasons for using spokes on solid sprockets.   (3)

9.4   State FOUR safety precautions you would observe when working on gearboxes.   (4)

[12]

TOTAL SECTION A: 60

SECTION B

Answer only TWO questions from this section.

QUESTION 10: HYDRAULICS AND PNEUMATICS

10.1   Explain the functions of the following hydraulic components:

10.1.1   Actuator

10.1.2   Reservoir

(2 × 1)   (2)

10.2   Make a neat, freehand sketch of the ISO symbols representing the following hydraulic or pneumatic components:

10.2.1   Check valve

10.2.2   Hydraulic pump

10.2.3   Motor

10.2.4   Accumulator

10.2.5   Single acting cylinder

(5 × 1)   (5)

10.3   Pneumatic systems require thorough daily maintenance so that they can continue working effectively and efficiently.

State THREE maintenance procedures that must be done on pneumatic systems.   (3)

10.4 List FIVE disadvantages of pneumatic systems. (5)

10.5 In pneumatic systems, which TWO factors are responsible for the force and speed in an actuator? (2)

10.6 Explain the functions of the following pneumatic components:

    10.6.1 Air receiver

    10.6.2 Piping

    10.6.3 Compressor

        (3 × 1) (3)
        [20]

QUESTION 11: CENTRE LATHES

11.1 Name FOUR types of mandrels that are used to hold a work piece in the chuck of a centre lathe. (4)

11.2 One of the methods used to set over the tailstock when taper turning on the lathe is the graduated sleeve method.

    11.2.1 State TWO advantages of using this method.

    11.2.2 State TWO disadvantages of using this method.

        (2 × 2) (4)

11.3 A 9 mm pitch, three-start square thread is to be cut on a centre lathe having a 7 mm pitch lead screw. The pitch diameter of the thread is 110 mm. Assume the clearance angle to be 3°. Calculate the following:

    11.3.1 The helix angle of the thread (3)

    11.3.2 The leading angle of the screw-cutting tool used (1)

    11.3.3 The following angle of the screw-cutting tool used (1)

11.4 The cutting speed for cutting cast iron with a tungsten carbide tipped tool is 25 m/min.

    Calculate the rotational speed of the spindle in revolutions per minute, when turning a shaft of 75 mm diameter. (3)

11.5 Name TWO types of commands (codes) applicable to programming on a CNC lathe. (2)

11.6 Explain TWO basic principles that apply to the programming of a CNC lathe to be able to machine a work piece with a simple profile. (2)
        [20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1   FIGURE 4 below shows a sketch of an index plate. Name the parts labelled A to D. Write only the name of the part next to the letter (A–D) in the ANSWER BOOK.
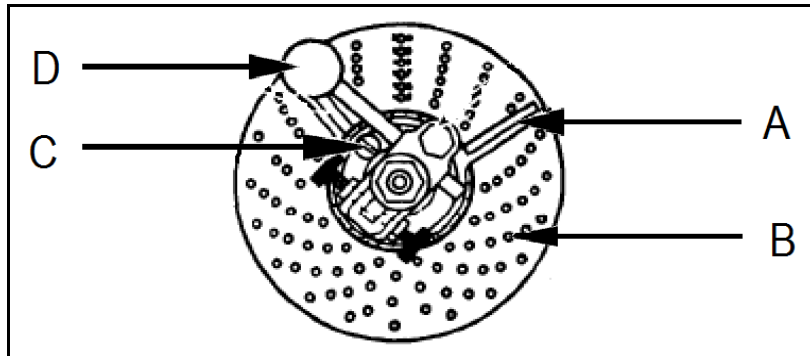
FIGURE 4   (4)

12.2   A gear blank has to be machined with 13 teeth on its circumference.

12.2.1   State the type of indexing required for machining the gear blank.   (1)

12.2.2   Give a reason for your answer in QUESTION 12.2.1.   (1)

12.2.3   Calculate the required indexing using a Cincinnati dividing head.

THE CINCINNATI DIVIDING HEAD											
Side	24	25	28	30	34	37	38	39	41	42	43
Side	46	47	49	51	53	54	57	58	59	62	66

(5)

12.3   State FOUR advantages of using helical milling cutters.   (4)

12.4   List FIVE types of bonding mediums which hold the abrasive particles together in grinding wheels.   (5)

[20]

TOTAL SECTION B: **40**
GRAND TOTAL: **100**

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FORMULA SHEET

$f = ft \times T \times N$

$S = \dfrac{\pi DN}{60}$

$S = \pi DN$

$\dfrac{40}{N}$

$\dfrac{N}{9°}$

$Set - over = \dfrac{D - d}{2} \times \dfrac{length\ of\ workpiece}{length\ of\ taper}$

$tan\ \dfrac{\theta}{2} = \dfrac{X}{L}$

$Leading\ angle =\ 90° - (Helix\ angle + clearance\ angle)$

$Following\ angle =\ 90° + (Helix\ angle - clearance\ angle)$

$Lead =\ No\ of\ starts \times pitch$