MEMORANDUM : APRIL 2006

NOTE: This memorandum does not make provision for all possible answers. This fact must be taken into consideration when the answers of the candidates are marked.

QUESTION 1

1.1 Advertise and propagate correct techniques by means of demonstration boards.
1.1.2 Prepare the worker by teaching him to known his work thoroughly.
1.1.3 Stress the necessity of proper lighting.
1.1.4 Maintenance of cables and electrical hand tools.
1.1.5 Protection of machinery.
1.1.6 Workshop conditions and the prevention of accidents by keeping the floors and walkways clear.

(ANY 3 FACTS = 3 MARKS)

1.2 Make sure that the chuck is well secured to the head stock.
1.2.2 Always remove the key from the chuck.
1.2.3 Turn the chuck by hand to make sure there is no bending or danger of the workpiece striking any part of the lathe.

(ANY 2 FACTS = 2 MARKS)

1.3 Any person who fails to obey any order given to him in accordance with or for the proper observance of the requirements of these regulations, or any order what so ever given in the interest of health or safety, by any person lawfully authorized to give such an order, shall be guilty of a contravention of these regulations.

(EACH FACT = 3 MARKS)

1.3.2 In any way likely to cause –

1. Disseminate of a harmful amount of dust.
2. Injury to any person.

To clean the body of a person or clothes worn by him.

(2)

[5]
2.1 13° 30' (1)

2.1.2 5° (5 minutes) or 1/12 of a degree. (i)

2.1.3 Measuring or setting out the angle of a work piece. (1)

2.2

2.2.1 Telescopic gauge – To take internal dimensions in conjunction with an outside micrometer. (1)

2.2.2 To determine the pitch of a thread. (1)

2.3

2.4

1) Measure the gap in piston rings.
2) Setting the gap on spark plugs.
3) Setting a flat work piece parallel to the movement of the shaper ram.
4) Testing clearance between machine slides.
5) Testing clearance on taper roller bearings. (2)

[ANY 2 FACTS = 2 MARKS] [11]
QUESTION 3

3.1 Left-hand screw thread is cut so that the nut must be turned to the left to screw on and the right-hand screw thread is cut so that the nut must be turned to the right to screw on.  

3.2

1. V-thread – 60° (1)
2. square thread – 90° (1)
3. acme thread – 29° (1)

3.3

d = 0.757 x P  
d = 0.757 x 2.5  
d = 1.89 m (1)

QUESTION 4

4.1 Metal that contain iron are ferrous metals and that does not contain iron are non-ferrous metal.

(EACH FACT 1 MARK = 2 MARKS)  (2)

4.2

1. Sound test  
2. Spark test  
3. Fracture test  
4. Machining test

(ANY THREE FACTS = 3 MARKS)  (3)

4.3

1. Hardening – it produces a hard wearing resistant part. (1)
2. Annealing – it softens the metal and makes it suitable for bending, drawing or other cold working operations. (1)
3. Normalising – refines the structure of steel and removes strains caused by cold working. (1)
4. Tempering – this reduces brittleness caused by hardening and increases toughness. (1)
5. Case Hardening – to give the metal a hard outer skin for wearing and a soft inner core to handle shock loads. (1)

4.4

1. Gears  
2. Bearings  
3. Sliding plates
4. Bolts and nuts
5. Fan blades
6. Trolley wheels

(ANY 2 FACTS = 2 MARKS)

QUESTION 5

5.1
1. Ruler. (1)
2. Square. (1)
3. Protractor. (1)
4. Center head. (1)

5.2 V-blocks are used to support round work pieces on the marking-off table. (1)

QUESTION 6

6.1

[Diagram of taper gibhead key]

[Diagram of woodruff key]

1 MARK EACH FOR NEATNESS = (2)
6.2
1. Shaping machine with rigid boring bars or with solid grooving tool.
2. Milling machine with slotting attachment or using side and face cutter or slot drill.
4. Key seat machine.

ANY 2 FACTS = 2 marks

QUESTION 7

7.1
1. Single – cut file
2. Double – cut file

7.2
1. Loose blade
2. Loose workpiece
3. Too much pressure on the blade

(ANY 2 FACTS = 2 MARKS )

7.3
7.3.1 Diamond point – clean out and finish off a square corner.
- cut a v – shaped groove in a workpiece.

(ANY 1 FACT = 1 MARK )

7.3.2 Pin pinch – to drive out straight pins, taper pins, cotter pins, keys, bolts and rivets which are cut or sheared.

(ANY 1 FACT = 1 MARK )

QUESTION 8

8.1
1. Set screw
2. Cap screw
3. Allen screw or grub screw
4. Hexagon socket screw

(ANY 2 TYPES = 2 MARKS)
8.2 The black bolt is a manufactured bolt according to a standard size, while a machine bolt is machined to fit a hole that has been made to a certain diameter. (2) [4]

QUESTION 9

9.1

1. Circular split die (1)
2. Two - piece rectangular die (1)
3. Solid die. (1)

9.2 To produce a perfectly round hole of a certain diameter with straight and smooth walls. (1)

9.3 When the final thread has to finish the hole. (1)

SECTION A = 60 MARKS

SECTION B

QUESTION 10

10.1

1. An improper ground point
2. When the feed is too long
3. Lands that are being worn away, the drill to bind in the hole.
4. The drill is clogged with chips causing fracture
5. An incorrectly ground, or blunt, drill point.
6. When the feed is too rapid or incorrect.
7. When insufficient coolant is being used.

(ANY 3 FACTS = 3 MARKS)

10.2 Counter boring is the process by which you enlarge the upper part of the drilled hole to accommodate round or cap – head screws. (1)
10.3 An angle plate is used to clamp and support awkward workpieces. 

10.4

\[ S = 30 \text{ m/min} \]
\[ D = 12 \text{ mm} \]
\[ \text{R.T.C.} \ N = r/\text{sec} \]
\[ S = \frac{30}{60} = 0.5 \text{ m/sec} \]
\[ D = \frac{12}{1000} = 0.012 \text{ m} \]

\[ S = \pi DN \]

\[ N = \frac{S}{TD} \]

\[ = \frac{0.5 \text{ m/sec}}{IT \times 0.012 \text{ m}} = \frac{0.5}{0.03766} = 13,266 \text{ r/sec} \]

QUESTION 11

11.1

- The material you have to grind and its hardness.
- The amount of material you must remove and the finish you require.
- Whether you have to do wet or dry grinding
- The wheel speed
- The area of grinding contact
1. Roughing tool

2. Grooving Tool
11.3 - Positive rake is when the wedge angle is less than 90°.
- Negative rake is when the cutting edge is strong and the wedge angle is 90°, cutting forces are larger because the chip is deformed.
- The cutting force are smaller and this sometimes helps to reduce vibrations.

1 FACT EACH = (2)

QUESTION 12

12.1

A – Ram. 
B – Table elevating shaft. 
C – Cross feed mechanism. 
D – Work table. 
E – Clapper box. 

12.2

Width - 180 mm.
Length of stroke - 320 mm - 0.32 m.
Feed for rough cut - 3 mm per minute.
Feed for finishing cut - 1.5 mm per minute.
Stroke ratio - 2:1, or 2/3
Finishing cut time - 4 min. 48 sec
Setting up time - 10 minutes.
12.2.1 Strokes per minute = \( \frac{\text{cutting speed (m/min)} \times \text{ratio}}{\text{length of stroke (m)}} \)

\[ = \frac{12 \text{ m per minute}}{0.32 \text{ m}} \times \frac{2}{3} \]

\[ = 37.5 \times 0.667 \]

\[ = 25.013 \text{ stroke/minute.} \]

12.2.2 Rough time = \( \frac{\text{width (mm)}}{\text{feed} \times \text{strokes per minute}} \)

\[ = \frac{180 \text{ mm}}{3 \text{ mm per stroke} \times 25.013 \text{ stroke per minute}} \]

\[ = \frac{180}{75.0375} \]

\[ = 2.398 \text{ minutes} \]

\[ = 2 \text{ minutes; } 23.88 \text{ seconds.} \]

12.2.3 Total time = 2 minutes / 23.88 seconds

\[ + 4 \text{ minutes} / 48 \text{ seconds} \]

\[ + 10 \text{ minutes} = 17 \text{ minutes} 11.88 \text{ seconds.} \]

\[ \text{(1)} \]

\[ \text{[10]} \]

QUESTION 13

13.1

1. You can reverse workpieces without loss of concentricity
2. You can take workpieces from the machine for inspection and reset them without loss of concentricity
3. You can also transfer workpieces between machines without loss of concentricity
4. You can machine long workpieces for the full length of the bed

\( \text{(ANY 2 FACTS } = 2 \text{ MARKS).} \)
13.2  
1. Fixed steady  
2. Travelling steady  

13.3  
1. General turning operations  
2. Taper turning  
3. Internal turning operations  
4. Drilling operations  
5. Facing  
6. Screw thread cutting  

(ANY 3 FACTS = 3 MARKS )

13.3  You can use a higher manufacturing speed.  
The finished part is more accurate.  
It gives a better surface finish.  
You can easily machine complex shapes.  
The CNC lathe does not require skilled operators to operate it  
It has a lower running cost.  
The life of the cutting tool is much greater due to its features such as constant  
surface speed and backlash compensation.  

(ANY 2 FACTS = 2 MARKS )

13.5 Ball centre is used when setting the tail stock for taper turning and also prevent  
uneven wear on the hole during taper turning.  

(1)

QUESTION 14

14.1  
1) You use it to machine flat surface on profile or shaped surface.  
2) You can drill with it.  
3) You can use it for boring  
4) Cut gears.  
5) It can be used to produce cams.  
6) You can adopt it for vertical work.  
7) You can do slotting or grooving.  

[ANY 4 FACTS = 4 MARKS]
14.2
A – Arbor. (1)
B – Bracing arms. (1)
C – Table trip (stops) (1)

14.3
1) Arbor – Drives and holds the cutters in their correct position. (1)
2) Bracing arms – Provide better support to the arbor and prevent vibration and chatter when you make heavy cuts. (1)
3) Table trips – Trips the automatic feed at pre-set positions. (1)

TOTAL SEATION B = 40 MARKS

GRAND TOTAL = 100 MARKS