*Name* : .....

*Roll No.* : .....

*Invigilator's Signature* : .....

**CS/B.Tech (ME)/SEM-5/ME-504/2009-10**

# 2009
# TECHNOLOGY OF MACHINING

*Time Allotted* : 3 Hours  Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

## GROUP – A
## ( Multiple Choice Type Questions )

1. Choose the correct alternatives for the following : 10 × 1 = 10

   i) Both the cutting motion and feed motion are imparted to the cutting tool in

      a) lathe for turning

      b) milling machine

      c) vertical boring machine

      d) horizontal boring machine.

   ii) The workpiece is reciprocated for cutting motion in

      a) shaping machine

      b) planing machine

      c) slotting machine

      d) cylindrical grinding machine.



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iii) Gear-teeth of internal spur gears can be produced in

a) milling machine

b) shaping machine

c) gear shaping machine

d) gear hobbing machine.

iv) Jigs and Fixtures are justifiably used in machine shops for

a) piece production b) batch production

c) mass production d) all of these.

v) Through cylindrical holes can be originated in solid bodies by machining in

a) drilling machine b) boring machine

c) broaching machine d) slotting machine.

vi) If '$t$' is the thickness of underformed chip in mm '$\Phi$' is the side cutting edge angle of the single point tool and '$s$' is the feed in mm/rev, then

a) $t = s.\sin\Phi$ b) $s = t.\sin\Phi$

c) $t = s.\cos\Phi$ d) $s = t.\cos\Phi$.

vii) Back Rack angle of a single point tool

a) by which the face of the tool is inclined sideways

b) by which the face of the tool is inclined towards back

c) by which the face of the tool is inclined with the flank

d) none of these.

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viii) Tool wear in carbide tool takes place due to

a) diffusion b) adhesion

c) abrasion d) all of these.

ix) Chip formation in turning a steel bar is basically a

a) simple shearing process

b) tearing process

c) plastic deformation process.

x) Criterion of tool-life in HSS tool is

a) flank wear

b) crater wear

c) fixed volume of chip removal

d) increase in power consumption by 20%.

## GROUP – B

### ( Short Answer Type Questions )

Answer any *three* of the following. $3 \times 5 = 15$

2. a) What is the effect of chip thickness ratio on shear plane angle ? $2\frac{1}{2}$

b) Compute shear strain for orthogonal cutting. $2\frac{1}{2}$

3. a) What is the principle of Merchant's model for determining shear plane angle in orthogonal cutting ? $2\frac{1}{2}$

b) Distinguish between shaping and planing. $2\frac{1}{2}$

4. a) What are the conditions favourable for Built-up Edge Formation ? $2\frac{1}{2}$

b) How are ploughing forces determined ? $2\frac{1}{2}$

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5. a) Explain the different mechanisms of tool wear ? $2\frac{1}{2}$

   b) What are the desirable properties of cutting tool materials ? $2\frac{1}{2}$

6. a) How is the abrasive selected for a grinding operation ? $2\frac{1}{2}$

   b) What is the specification of a grinding wheel for grinding steel *C*-40 ? $2\frac{1}{2}$

## GROUP – C
## ( Long Answer Type Questions )

Answer any *three* of the following. $3 \times 15 = 45$

7. Describe briefly with the help of suitable sketches the methods of production of external screw threads by rolling different types of dies. 15

8. a) The following observations were made during orthogonal cutting of an aluminium alloy : thickness of uncut chip ( $t$ ) = 0·18 mm, width of uncut chip ( $b$ ) = 4·0 mm, length of uncut chip ( $l$ ) = 165 mm, length of the chip ( $l_c$ ) = 45 mm, width of the chip ( $b_c$ ) = 4·5 mm, $\mu$ = 0·75, $\tau$ = 245 N/mm$^2$, $V$ = 35 m/min, $\alpha$ = 20°, Calculate :

   i) Cutting force

   ii) Feed force

   iii) Power consumption. 5



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b) During shaping ( like single point machining/turning ) a steel plate at feed, 0·20 mm/stroke and depth 4 mm by a tool of $\lambda = \gamma = 0^\circ$ and $\varphi = 90^\circ$ $P_Z$ and $P_X$ were found ( measured by dynamometer ) to be 800 N and 400 N respectively. Chip thickness $a_2$ is 0·4 mm. From the aforesaid conditions and using Merchant's circle diagram, determine the yield shear strength of the work material in the machining condition ? 5

c) Sketch a HSS twist drill to show principal geometrical specifications. 5

9. a) A cast-iron surface 300 mm long and 180 mm wide is to be machined on a shaper with cutting-to-return ratio of 3 : 2. Cutting speed, feed and clearance are 24 m/min, 2 mm/double stroke and 30 mm respectively. The available ram strokes on the shaper are 28, 40, 60 and 90 strokes/min. If the depth of cut is 3·5 mm, determine

i) Time required machining the surface

ii) Material removal rate. 5

b) What are the basic elements or components of jigs and fixtures ? 5

c) What are the different methods of application of cutting fluid ? 5



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10. a) Explain the bar feeding mechanism used in Turret & Capstan lathe.

b) What is 'centreless grinding' ? Explain the operation with a neat sketch.

c) What is the meaning of the term 'vehicle' used in lapping ? With the aid of a sketch, show the principle of superfinishing. 5 + 5 + 5

11. a) Define tool wear. Explain in brief about the basic mechanism of wear formation. Write the principal types of wear accruing in the cutting tool ( with a neat sketch ). 1 + 2 + 2

b) Explain how tool life is affected by tool geometry. 3

c) The following data were recorded while turning a mild steel rod on a lathe :

Cutting speed = 30 m/min, feed rate = 0·25 mm/rev, depth of cut = 2·0, tool life = 90 minutes.

The following tool life equation is given by the equation $VT^{0.12} f^{0.7} t^{0.3} = C$. If the cutting speed is increased by 25%, what will be the effect on tool life ? 5

d) What do you understand by machinability rating ? Name one method of it. 2



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12. a) A 2-start external square thread of 10 mm pitch and outside diameter of 62 mm is to be cut on a centre lathe which has a 6 mm pitch lead screw. Calculate

    i) Depth of thread to give a clearance of 0·12 mm

    ii) Lead to the thread

    iii) Gear ratio. 5

    b) Distinguish between mass production and batch production. 5

    c) What is piece production ? How does it differ from batch production ? 5

13. a) Calculate the time required to mill a slot of 350 mm × 30 mm in a mild steel workpiece of 350 mm length with a side and face milling cutter of 120 mm diameter, 30 mm wide and having 20 teeth. The depth of cut is 6 mm, the feed per tooth is 0·1 mm and cutting speed is 34 m/min. Assume overtravel distance of 5 mm. 5

    b) Obtain indexing for 51 divisions. 5

    c) What is honing and lapping ? 5

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