MECHANICAL ENGINEERING DEPARTMENT
I.I.T. KANPUR
TA 201N
Second mid. Sem. Exam.

Max. Marks = **60**

March 09, 2011, Time: 8.00 - 9.00 AM

NOTES: VKJ / smse / 10-11

(I) Answers should be brief and to-the-point, and be supplemented with neat sketches if necessary.
(II) Figures on the right-hand side within parentheses indicate full marks.
(III) Attempt the questions in the order they are given.
(IV) Start a new question from a new page.
(V) All the abbreviations used should be clearly stated what they stand for.

Q1

(i) Draw three orthographic views of a single point turning tool. Show the angles, and nose radius in the appropriate views. The tool specifications are as follows: -6, 10, 5, 7, 9, 11, 3mm. **[8]**

(ii) Choose the most appropriate answer: **[4]**

(a) Time taken to machine a 2.5 cm long shaft at 300 RPM and feed rate of 0.25 mm/rev. will be: (a_1) 10 s, (a_2) 40 s, (a_3) 20 s, (a_4) 50 s, (a_5) None of these.

(b) During turning of a M.S. shaft, chip thickness ratio will be: (b_1) >1, (b_2) <1, (b_3) =1.

(c) The continuous chip with BUE compared to continuous chip without BUE under the same machining conditions: (c_1) yields better surface finish, (c_2) yields worse surface finish, (c_3) BUE has no effect on surface roughness.

Q2.

(i) Draw a three relationship (curve) between machining time and flank wear for HSS single point turning tool. Name the parameters of ordinate and abscissa, and also write their units. Assume maximum permissible flank wear as 1.00 mm. In your opinion, in which zone this 1 mm limit should lie? **[4]**

(ii) Draw a tool (single point) in cutting action, and show PSDZ, SSDZ and other elements of the cutting zone (rake angle, clearance angle, shear angle, chip tool and workpiece). Also, show three sources of heat generation. **[4]**

(iii) Draw a free body diagram of a chip formed during turning and show the various forces acting on it. Write the name of each force and show its direction of action. **[4]**

Q.3

(i) During turning of a M.S. workpiece using HSS tool, the feed rate used is 0.05 mm/rev, and nose radius of the tool is 0.5 mm. The back rake angle is maintained as + 8^0. What is the expected surface roughness value of the machined surface in terms of R_{CLA} and R_{max} both? Write its unit also. **[4]**

(II) A cylindrical bar has a blind hole of 15 mm diameter. Its face is being turned from inner diameter to the outer periphery at a speed of 600 RPM, feed rate of 0.3 mm/rev, and depth of cut of 1.0 mm. Find out the cutting speed and the total volume of material removed at the end of 15 seconds. **[5]**

(iii) Choose the most appropriate answer**:** **[1x3]**

(a): Shear plane angle is the angle between (a1) shear plane and the machined surface, (a2) shear plane and rake face of the tool, (a3) rake face of the tool and the vertical plane, (a4) shear plane and horizontal plane, (a5) none of these.

(b): If 'L' is the length parallel to the axis of a tapered job (Fig. 1) to be turned 'd' is diameter, 'f ' is feed rate and 'N' is spindle speed. Write in terms L, f, etc., the time taken to complete a single pass turning operation. Assume 5^o as the taper angle.

(c): Which process will you recommend to make *a 'missile nose cone*' from a circular sheet?

Q4. (a). A steel slab has thickness = 0.3 m, and width = 1.0 m. It is hot rolled such that the % reduction in rolling comes out to be 9 %. Following data are given**:** **C**oefficient of friction = 0.3, Rolling speed = 72 m/min, Roll diameter = 0.6 m, m (Strain rate exponent) = 0.1, C (Strength coefficient) = 120 MPa, and Q_i = 2.0.

Calculate the following:

Final thickness of the rolled sheet, true strain, length of contact during rolling, strain rate, flow stress of the slab, rolling force, and power required. **[7]**

(b). (i) Write an equation for calculating maximum spinning reduction in %. **[1]**

(ii) For machining a casting (non-circular) on a lathe machine, the casting should be held in:

(A) collet chuck, (B) face plate, (C) four jaws chuck, (D) three jaws chuck, (E) None of these. **[1]**

(iii) With the help of a figure, differentiate between punching and blanking operations performed on a metal sheet**.** **[1]**

(iv) The power is transmitted by a lead screw to the carriage through.**:**

(A) Gear box, (B) rack and pinion, (C) half nut, (D) worm and gear**.** **[1]**

(v) With HSS tools, highest cutting speed can be used while machining: **[1]**

(A) C.I., (B) M.S., (C) Aluminium, (D) Brass.

Q5. (i). (A) On which parameter the strength of a cutting tool depends: **[1]**

(a) Nose radius, (b) Side cutting edge angle, (c) Back rake angle, (d) None of these.

(B) Machinability depends upon: (a) Microstructure, Physical and Mechanical Properties of tool material, (b) Tool – life, (c) Work profile, d) None of these. **[1]**

(C) A HSS tool has following specification: 16-4-4-2. What these numbers indicate? **[1]**

(ii). (a) Two single point turning tools are specified as follows. Which of these tools is stronger? **A.** 0, 10, 6, 6, 10, 15, 2 mm; **B**. 15, 12, 6, 6, 10, 15, 3 mm **[2]**

(b) "A precision component is being turned on a lathe machine for which control of dimensions is most important". Which tool failure criterion will you recommend and why? **[3]**

(c) "Use of a chip breaker can result in a better surface finish on the machined workpiece made of brass". Is this a true statement? Justify your answer**.** **[3]**

(d) Two cutting fluids are designated as **A** and **B**. **A** has higher specific heat and higher electrical conductivity than **B**. Which of these two cutting fluids will give better performance? **[1]**

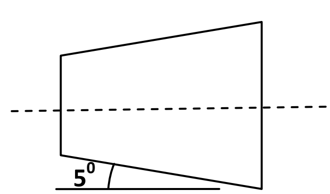

Fig.1

GOOD LUCK