Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/M. Tech (MT)/SEM-1/MTI-103/2011-12

2011

MACHINING SCIENCE AND MACHINE TOOLS

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.

Answer any *five* of the following questions.

$5 \times 14 = 70$

1. a) Write three attributes of cutting tool materials.   3

    b) Name four common tool materials.   2

    c) Explain the properties and application of HSS tools.   5

    d) Explain the general relationship of tool wear versus cutting speed with a neat sketch.   4

2. a) Show the different parts of a single point cutting tool with a neat sketch.   4

    b) Explain the normal rake system (ISO System) of tool nomenclature with a neat sketch.   4

    c) Show the main elements of a standard drill with a neat sketch.   6

3. a) Name the main types of chips in machining process.   2

    b) Distinguish between orthogonal cutting and oblique cutting with a neat sketch.   4

40689   [Turn over

    c)   Explain the working principle of a three dimensional lathe tool dynamometer with a neat sketch.   5

    d)   In an experiment on orthogonal cutting, a chip length of 85 mm was obtained from an uncut length of 202 mm while cutting with a tool of $20°$ rake angle using a depth of cut of 0·5 mm. Determine the shear plane angle and chip thickness.   3

4.   a)   Explain the working principle of tool-work piece thermocouple to determine the cutting tool temperature.   4

    b)   Write five desirable properties of cutting fluid.   3

    c)   Give the broad guidelines for selection of cutting fluid.   2

    d)   Name two recommended cutting fluids for aluminium, carbon steels and high speed steels.   5

5.   a)   Write five costs associated with machining operations.   5

    b)   A bar is to be turned on a lathe with following parameters :

Length of bar L mm

Feed F mm/rev

speed N rpm

Diameter of bar D mm.

Cost of operating machine per unit time C_u

Time for loading and unloading T_n

Cost per cutting edge of tool C_e

Tool life T minutes

Tool setting cost T_s

Determine i) T_0 the time of machining the job completely. 4

     ii) R_p rate of production   1

     iii) T_{opt} time for machining for optimum cutting.   1

     iv) V_{opt} optimum cutting speed considering minimum cost in turning   3

6.   a)   Classify the machine tool structures according to their functions.   3

     b)   Write basic requirements of machine tool beds.   3

     c)   Derive the condition for design of a machine tool bed having length l, breadth b and height h loaded by a concentrated load p at the centre to the Young's modulus, allowable normal stress and permissible deflection of bed are E, σ_a, δ_a respectively.   6

     d)   What is the nature of loading in machine tool column ? 2

7.   a)   Find the speed steps arranged in geometric progression for the following condition :

         $n_{min} = 12 \, rpm$, $n_{max} = 510 \, rpm$, $Z = 8$.

         carry at the productivity analysis for the speed layout.   6

     b)   Derive the expression for range of spindle speeds for turning if $V_{c\,max}$ and $V_{c\,mix}$ are the maximum and minimum cutting speeds and D_{max} and D_{min} are the maximum and minimum job diameters.   4

c) Draw all the structural diagrams of two-stage gearbox with 16 numbers of steps. 4

8. a) Define automation. 2

b) Derive the expression for h_t, index for degree of automation where t_m is 'mechanized' machine time, non-overlapped total and t_n is non-overlapped idle time for setting and handling working members and auxilliary devices. 3

c) Differentiate between turret lathe and capstan lathe. 3

d) Explain the working principle of template controlled copy milling machine. 6

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