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CMR

Internal Assesment Test - II

Sub:	Machine Tools & Operations							Code:	15ME45B
Date:	09 / 05 / 2017	Duration:	90 mins	Max Marks:	50	Sem:	IV	Branch:	MECH

Answer Any FIVE full Questions

			Marks	OBE	
				CO	RBT
1	A)	Describe different types of Tool motions in machining process	[4]	CO2	L1
	B)	Briefly explain the desirable properties of cutting tool material	[6]	CO3	L2
2		Derive the equations for the following machining parameters for turning operations spindle speed, cutting speed, cutting time, depth of cut, feed rate and material removal rate.	[10]	CO2	L3
3		A mild steel bar of 63mm diameter and 200 mm long is to be turned to 60 mm diameter with the help of a HSS tool. Determine the cutting speed and time of machining if the approach length is set at 5mm and feed is set at 0.2mm/rev.	[10]	CO2	L3
4		Estimate the time required to machine a cast iron surface 250 mm long and 150 mm wide on a shaper with cutting to return ratio of 3:2. Use a cutting speed of feed of 21mm/min, a feed of 2mm stroke and a clearance of 25 mm. the available ram strokes on the shaper are 28,40,60 & 90 strokes/min. also, determine MRR assuming depth of cut as 4mm.	[10]	CO2	L3
5	A)	Briefly explain the elements of single point tool with a neat sketch	[6]	CO3	L2
	B)	Write short notes on the following cutting tool materials: (a) HSS (b) CBN	[4]	CO3	L1
6		With a neat sketch, briefly explain the following for a single point cutting tool, (a) Back rake angle (b) End clearance angle (c) Side cutting edge angle (d) Nose radius	[10]	CO3	L1
7		Derive the equations for the following machining parameters for slab milling operations spindle speed, cutting speed, cutting time, depth of cut, feed rate and material removal rate.	[10]	CO2	L3

Machine Tools & Operations

Scheme of Evaluation.

Internal Assessment - 2

Sub code - 15ME45B

1)

A) Definition of machine tool — 2

Types of Tool motions

1) Primary motion or Cutting motion — 2

2) Auxiliary motion — 2

B) Properties of cutting tool

1) Hot hardness — 1

2) Toughness and impact strength — 1

3) Coefficient of thermal expansion — 1

4) Wear resistance. — 1

5) Chemically stability — 1

6) Cost — 1

2) 1) Spindle speed - It is expressed in RPM and it is denoted by letter 'N'. — 1

2) Cutting speed - It is the relative speed at which the tool passes through — 1

the w/p material and removes the metal. It is expressed in m/min.

If V is the cutting speed,
N is the spindle speed.
D is the diameter of the w/p. 2

Then

$$V = \frac{\pi D N}{1000} \quad m/min$$

or.

$$V = \pi D N \quad mm/min.$$

3) Cutting time (T_c)

It is the time taken to cut per pass and is denoted by (T_c)

If L is the length to be turned. 2

$$T_c = \frac{L}{fN} \quad min.$$

4) Depth of cut

It indicates how much the tool digs into the w/p during each pass and is denoted by letter 'd' and is measured in mm. 1

5) Feed Rate -

The relative speed at which the tool is linearly traversed over the w/p to remove the material. 1

6) Material Removal Rate

It is the total volume of material being removed per unit time.

MRR = cutting speed × feed × depth of cut 2

MRR = $\pi DNft$ mm^3/min.

3)

Given

$D_1 = 63$ mm $\quad D_2 = 60$ mm

$t = \frac{D_1 - D_2}{2} = \frac{63-60}{2} = 1.5$ mm.

Length of job = 200 mm = L_j

$f = 0.2$ mm/rev

Length of approach = 5 mm = L_{app}.

Let us assume ~~Speed~~ Spindle speed. $= N = 200$ rpm

Machining speed.

or

Cutting speed $= V = \frac{\pi DN}{1000}$ m/min

$= \frac{\pi \times 63 \times 200}{1000}$ 5

$V = 39.58$ m/min

Cutting time $= T_c = \frac{L}{fN}$

$= \frac{L_j + L_{app}}{fN} = \frac{200+5}{0.2 \times 200}$ 5

$= 5.125$ min

4) Given

$L_j = 250$ mm
$b = 150$ mm.
$m = \frac{2}{3} = 0.667$
$V = 21$ m/min
$f = 2$ mm/stroke.
$C = 25$ mm
$t = 4$ mm

Total length of stroke $= L_j + 2C$.
$= 250 + (2 \times 25)$ 1
$L = 300$ mm.

we, know

$$V = \frac{N_s L(1+m)}{1000}$$

$$\therefore N_s = \frac{V \times 1000}{L(1+m)} = \frac{21 \times 1000}{300(1+0.667)}$$ 3

$N_s = 41.9$ strokes/min.
$N_s \simeq 42$ strokes/min

Nearest available ram strokes is 40 strokes/min which is very near to the calculated value.

$\Rightarrow N_s = 40$ strokes/min

Thus

machining time $= T_c = \frac{b}{N_s f}$ min 3

$$T_c = \frac{150}{40 \times 2}$$

$T_c = 1.875$ min

Material Removal Rate (MRR)

$$MRR = f \cdot d \cdot N_s \cdot L \cdot (1+m)$$

$$= 2 \times 4 \times 40 \times 300 \times (1+0.667)$$

$$MRR = 160032 \ mm^3/min.$$ — 3

5)

A) * Sketch of single point cutting tool — 2

* Flank
* Heel
* Base
* Face
* cutting edges. — 4

B) Brief explanation of HSS & CBN — 2+2

6)

* 2D sketch of single point cutting tool — 4
* Back rake angle
* End clearance angle — 3
* Side cutting edge
* Nose radius — 3

7) Slab milling parameters.

1) Spindle speed - Sp. Rotational motion of arbor and is denoted by letter 'N' is measured in rpm. 1

2) Cutting speed. - It is the linear velocity of any point on the periphery of the cutting edge. It is expressed in m/min. 2

$$V = \frac{\pi DN}{1000} \quad m/min.$$

where.

D = dia. of w/p.

N = speed of the spindle.

3) Feed Rate - It is the rate with which the w/p moves under the cutter while milling. It is expressed as mm/tooth of cutter (f_t) or mm/rev of cutter (f_r) or mm/min (f_m). 2

$$f_m = f_t \times Z \times N \quad mm/min$$

4) Depth of cut - It is the thickness of the metal removed from the w/p in one pass of the cutter on the w/p. It is expressed in mm. 1

Machining time.

It is the total time taken to mill a given surface on a w/p. A milling cutter does not make a complete cut when it first comes in contact with the w/p.

$$T_m = \frac{L + L_A + C_1 + C_2}{f_m}$$

2

where

L_A = length of tool approach

C_1 & C_2 = are the clearances on both sides of the w/p.

$$L_A = \sqrt{t(D-t)}$$

Material Removal Rate (MRR)

$$MRR = \frac{b \times t \times f_m}{1000} \quad mm^3/min$$

where

b = width of cut, mm

t = depth of cut, mm.

f_m = feed rate mm/min.

2