CMRIT

Scheme Of Evaluation
Internal Assessment Test 1 – March.2019

Sub:	Additive Manufacturing							Code:	15ME82
Date:	06/03/2019	Duration:	90mins	Max Marks:	50	Sem:	VIII	Branch:	ME

Note: Answer Any Five Questions

Question #	Description	Marks Distribution		Max Marks
1	**Define Additive Manufacturing and tabulate the different types of AM** • Definition of AM • Classification of AM	2 M 8 M	10 M	10 M
2	**Describe the different post processing techniques of AM parts** Support Material Removal Surface Texture Improvements Accuracy Improvements Aesthetic Improvements Preparation for use as a Pattern Property Enhancements using Non-Thermal Techniques Property Enhancements using Thermal Techniques	2M 1M 2M 1M 1M 2M 1M	10M	10M
3	**With a neat flow chart explain the AM process chain** • Conceptualization and CAD • Conversion to STL • Transfer and manipulation of STL file on AM machine • Machine setup • Build • Part removal and cleanup • Post-processing of part • Application	1M 2M 2M 2M 1M 2M	10M	10M

4	**Explain with the neat sketch different hydraulic motors** Geared Motor Vane motors Piston motors Turbine motors	2.5M 2.5M 2.5M 2.5M	10M	10M
5	**Explain with a neat sketch the different Pneumatic actuators** Linear Motors Rotary motors	5M 5M	10M	10M
6	**Describe the selection methods for a part fabricated by AM process** Decision theory Approaches to Determining Feasibility Approaches to selection Selection Examples	2.5M 2.5M 2.5M 2.5M	10M	10M

Substitute equation (7) in (4)

$$F_c = \frac{\tau_m A_o}{\sin\phi} \frac{\cos(\beta-\alpha)}{\cos(\phi+\beta-\alpha)} \quad \text{———(viii)}$$

According to Ernst and Merchant Angle ϕ That value which is Required minimum force to the Merchant. considering A_o & Shear force of independent of shear angle.
differentiate equation (8) with respect to shear angle and equating to zero.

It becomes

$$2\phi + \beta - \alpha = \pi/2$$

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(2) Briefly Explain the process parameters that influence tool life.

Tool life is affected by the following parameters

(i) cutting conditions
(ii) Tool geometry
(iii) Tool material
(iv) work material
(v) condition of the tool work interface.

* The cutting condition are Related by the equation $VT^n f^m d^l = C$. where n.m & l constants depend on tool and work materials.

Increasing the Rake angle decreases the cutting forces and hence decrease in heat produced. This Results is increased tool life. But the value of Rake angle must not be increased too much as it Results in Reduced tool material for heat conduction

* Carbide tool have higher tool life than HSS for the identical conditions of machining.

* Hardness, microstructure. and different phases influence tool life. work material having soft phases like ferrite in steel form BUE and Results in poor Surface finish. Cast iron having graphite phase enhances tool life.

* Dry condition increases temperature of the tool and Reduces tool life. use of cutting fluid provides lubrication and carries away heat as well.

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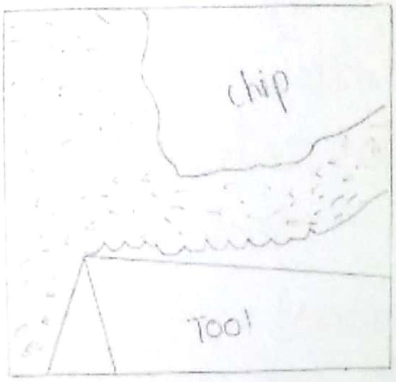
(3) Explain with neat sketches the different types of chips formed during metal cutting process.

The chips formed during cutting may be of the following types

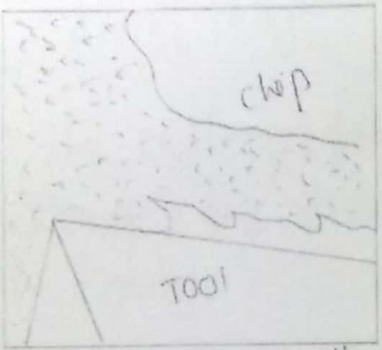
(i) Continuous chip: This type of chip is formed commonly in all ductile materials such as wrought iron. mild steel, Aluminium and copper.



Continuous chip

The formation of the chip takes place in the zone extending from the tool cutting edge to the junction between the surfaces of the chip and work piece. The zone is known the primary deformation zone.

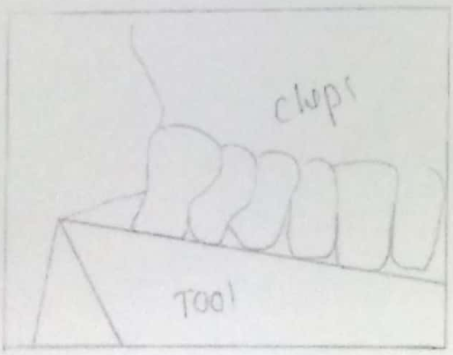
(ii) Continuous chip with built up edges (BUE)



Continuous chip with built up edges.

under certain conditions the friction between the chip and the tool is so great that the chip material welds itself to the tool surface. due to the presence of this welded metal there will be further increase in friction. This Results in building up of layer upon layer of chip material

(iii) Discontinuous chip :



Discontinuous chip

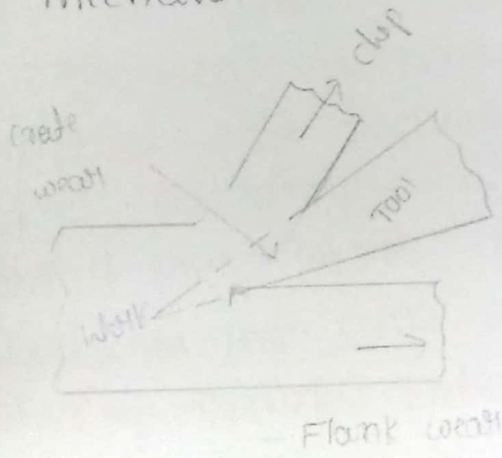
while the chip is being formed severe strain is set up and If the work piece is brittle, fracture will occur in the primary deformation zone when the chip is only partly formed. The chip is segmented and the condition is Refered to as discontinuous chip formation.

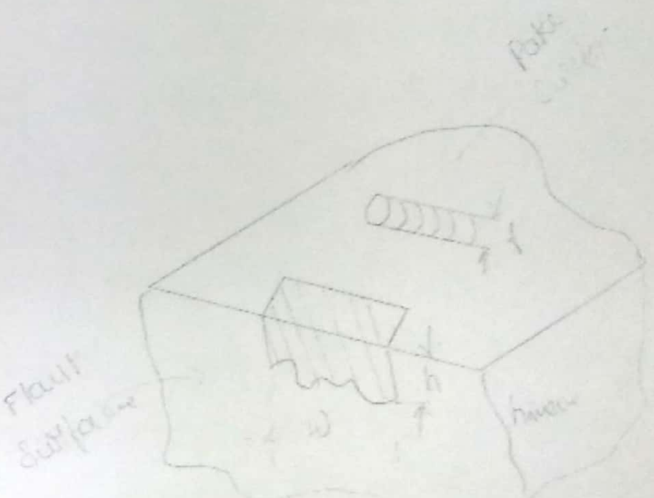
(4)

(A) List the differences between orthogonal cutting and oblique cutting

orthogonal cutting	oblique cutting.
(i) cutting edge of the tool is perpendicular to the direction of the velocity vector	(i) cutting edge of the tool makes an angle with the normal to the cutting velocity vector.
(ii) The chip formed flows on the Rake face of the tool with chip velocity perpendicular to the cutting edge	(ii) The chip formed flows on the Rake angle face of the tool at an angle with the normal to the cutting edge in the plane of the face
(iii) The cutting forces act along X & Z directions only.	(iii) The cutting forces act along all the three directions Y and Z.

(B) Explain with neat sketches the different types of chips formed during metal tool wear mechanisms.





Wear take place on the surface along which there is sliding action. In the case of a cutting tool, the wear takes place on the Rake surface where the chip flows over the tool and on the flank surface where Rubbing action b/w work and tool occurs.

These wear are the called as the crater wear and Flank wear. During wear process. Abrasion wear. Adhesion wear and diffusion wear mechanisms will be active depending on various conditions.

Abrasion and Adhesion wear as primarily Responsible for the flank wear.

Diffusion wear may play an important Role in crater wear at a high speed

Flank wear is a worn surface below the cutting edge. Flank wear takes place when machining brittle materials like cast iron or when feed is less than 0.15 mm/rev. ht = width or wear land of wear

h_f = ht of wear of flank hmax = max. ht of flank wear

Crater wear occurs in the form of a depression on the Rake surface due to pressure of the chip on the Rake during sliding.

(5) The following data were obtained during orthogonal turning of a certain workpiece material. chip thickness = 0.45 mm. width of cut = 2.5 mm feed = 0.25 mm/rev. cutting material force = 113 kg Thrust force = 29.5 kg. The cutting speed was 150 m/min and the Rake angle was +10°. Calculate the following

(a) Chip thickness Ratio, (b) Chip Reduction co-efficient.
(c) shear angle (d) Velocity of chip along the tool face
(e) Frictional force along the tool face. (f) shear stress
(g) power Required for cutting.

Soln

Given data

$t_2 = 0.45$ mm

$b_1 = 2.5$ mm

$f = t_1 = 0.25$ mm/rev

$F_c = 113$ kg $= 1108.53$ N

$F_t = 29.5$ kg $= 289.395$ N

$V_c = 150$ m/min

$\alpha = 10^\circ$

(a) Chipthickness Ratio $= r = \frac{t_1}{t_2} = \frac{0.25}{0.45} \Rightarrow 0.555$

(b) Chip Reduction coef^{nt} $= K = 1/r = 1.801$

(c) Shear angle

$$\phi = \tan^{-1}\left(\frac{r\cos\alpha}{1 - r\sin\alpha}\right) = \tan^{-1}\left(\frac{0.55\cos 10}{1 - 0.555\sin 10}\right)$$

$$\phi = 30.674^\circ$$

(d) velocity of chip

$$V_s = rV_c \Rightarrow 0.55(150)$$

$$V_s = 83.25 \text{ m/min}$$

(e) Frictional force along tool face

$$F_f = F_c \sin\alpha + F_t \cos\alpha$$

$$F_f = 477.48 \text{N}$$

Scanned by CamScanner

(f) Shear stress

$\tau = F_s / A_1$

$F_s = F_c \cos\phi - F_t \sin\phi$

$= 1108.53 (\cos 30.67) - 289.395 \sin 30.67$

$F_s = 805.85 N$

$A_1 = \frac{A_0}{\sin\phi} = \frac{b_1 t_1}{\sin\phi} = \frac{2.5 (0.25)}{\sin(30.67)}$

$A_1 = 1.225 mm^2$

$\tau = \frac{805.85}{1.225} \Rightarrow 657.836 N/mm^2$

(g) power Required

$P = \frac{V_c F_c}{60000}$ kW

$= \frac{150(1108.53)}{60000}$

$P = 2.77 kW$

(6) The tool life for HSS tool is expressed by the Relation $VT^{1/7} = C_1$ and for Tungsten carbide tool it is $VT^{1/5} = C_2$. If the tool life for a cutting Speed of 24 m/min is 128 min. Compare the life of the two tools at a speed of 30 m/min.

Sol

Data given

HSS tool = $VT^{1/7} = C_1$

Tungsten carbide tool ⇒ $VT^{1/5} = C_2$

$V_1 = 24$ m/min , $T_1 = 128$ min

$V_2 = 30$ m/min $T_2 = ?$

For HSS tool,

$V_1 T_1^{1/7} = V_2 T_2^{1/7}$

$24 (128)^{1/7} = 30 (T_2^{1/7})$

$T_2 = 26.843$ mins

For Tungsten carbide tool

$V_1 T_1^{1/5} = V_2 T_2^{1/5}$

$24 (128)^{1/5} \; 30 T_2^{1/5}$

$T_2 = 41.943$ mins