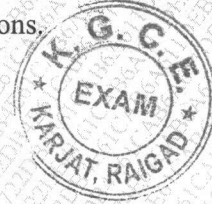(3 Hours)   (Total Marks : 80)

Note: (1) **Question No. 1** is compulsory

(2) Attempt **any three** questions out of the remaining five questions.

(3) Assume suitable **data** wherever **necessary** and **justify it**.

(4) **Figures** to the **right** indicates **full marks**.

Q1	a	What are essential properties of cutting tool materials?	(05)
	b	Explain machinability and factors affecting it.	(05)
	c	Explain the chip breaking methods in single point tools.	(05)
	d	Why differential pitch is provided on broach?	(05)

Q2	a	Derive the relationship between MRS rake angles and ORS rake angles by method of slope.	(08)
	b	Derive an expression for Taylor's exponent by Taper turning test.	(08)
	c	Write a short note on Face and crater tool wear	(04)

Q3   a   In a turning operation on a mild steel tube with a 2.5 mm thickness, an end-   (14)
cutting test was performed using a tool with a zero lead angle (which
represents an orthogonal cutting test). The feed was 0.3 mm/rev, the rake
angle of the tool was zero, and the cutting speed was 200 m/min. Several
parameters were measured during this end-turning operation. The average
chip thickness was measured with a point micrometer and found to be 0.7
mm. The tool–chip contact length (on the rake face) was estimated to be 0.5
mm. The cutting forces were measured with a dynamometer mounted under
the toolholder. The tangential cutting and axial (feed) forces were 900 and
600 N, respectively.

Find : (i) Shear angle and Shear force, (ii) Friction force and friction angle
(iii) Resultant force,(iv) Shear Velocity and Chip Velocity, (v) Average Shear
Stress and Normal Stress on shear plane

   b   Derive the expression for Merchant's constant considering the effect of   (06)
normal stress on shear plane.

Q4   a   The tool life for carbide tool is expressed by the relation $V.T.^{0.25} = 800$ and   (10)
for aluminium oxide tool is $VT^{1.25} = 8000$ while machining medium carbon
steel. Calculate the break even cutting speed above which oxide will give
better tool life.

b Explain how form relieving is achieved in milling cutters. (06)

c Find the expression for finding the chip length and chip thickness in up- milling process. (04)

Q5 a Calculate the following features needed in designing a round progressive cutting HSS broach for machining a hole 46H8 diameter, length 72 mm in a steel work piece with σ_t = 72 kgf per sqmm. The hole diameter before broaching is 44 H11. The broached surface finish is R_a = 2 microns. The cut per tooth is 0.03 mm. Broaching force per mm of cutting edge length is 24 kgf. Permissible stress in HSS broach is not to exceed 28 kgf per sq.mm. a) number of broach teeth and teeth length. b) broach teeth pitch and other teeth details. c) last cutting tooth diameter and its tolerance. d) stress induced in the neck section. (12)

b Discuss the influence of different machining parameters on the temperature generated during metal cutting operation. (08)

Q6 a Derive an expression for optimum cutting speed and optimum tool life for minimum cost of production assuming that the tool follows Taylor's tool life equation. (06)

b Write short note on turning tool force dynamometers. (06)

c With own example show how profile depth in circular form tool can be calculated. (08)

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