V / Prod/ CBGS/ MST / 17.05.16

Machining Science & Tech.

QP Code : 31085

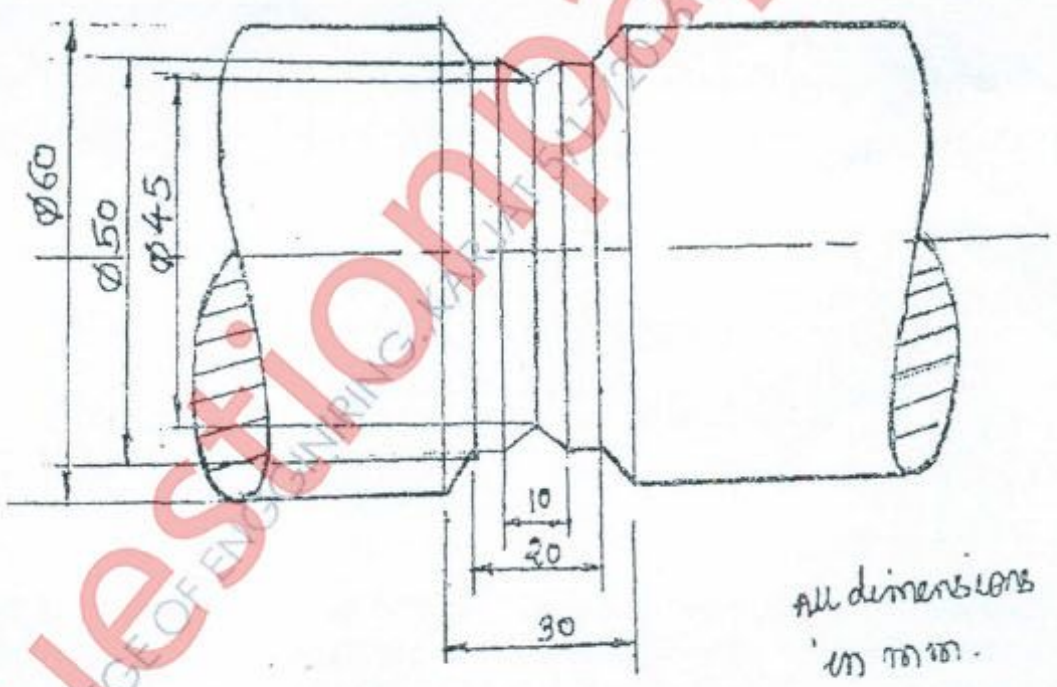
(3 Hours)

[Total Marks: 80]

N.B. (1) Question **No.1** is compulsory
(2) Answer any **three** questions out of the remaining **five** questions.
(3) Assume suitable data if necessary and state them clearly.
(4) Figures to the right indicate **Full Marks**.

Q.1. Explain briefly:- 20
(a) Taylor's tool life equation.
(b) ORS system of tool nomenclature.
(c) Coated carbide tools.
(d) Surface integrity during machining.

Q.2. (a) Design and draw a circular form tool for forming the workpiece as shown in the figure below. The bar is bright drawn 60 mm diameter steel bar. Assume rake and clearance angle 10^0 and 6° respectively. The form tool is of H.S.S. material. Check the profile dimensions analytically also. 12



(b) Derive an expression for Merchants orthogonal cutting model considering the effect of normal compressive stress on the shear plane (Merchant's modified theory). 8

[TURNOVER

Q.3. (a) Design a lathe turning tool tipped with cemented carbide for roughing a shaft of steel grade 45, ultimate strength σ_t 750 MPa, diameter D = 80 mm, allowance per side t = 3·5 mm, at feed s = 0·3 mm/rev and tool overhang = 60 mm. Assume following data : 8

$F_z = 9.81\, C_{F_Z}\, t^{X_Z}\, s^{Y_Z}\, K_Z$, Where C_{F_Z} = 300, Xz = 1, Yz = 0 · 75, Kz = 1.

(b) Calculate and design round progressive broach for machining cylindrical hole of dia. $30H_7$ and an axial length of 120 mm in a workpiece of carbon steel. The hole diameter before broaching is 28 mm. Assume cut per tooth in the range of 0.05 to 0.1 mm and the broaching force required per 'mm' of cutting edge length to be 210 N/mm. The broach is of H.S.S. and permissible stress not to exceed 250 N/mm^2. 12

Q.4. (a) A 50 mm long, 40 mm dia. alloy steel workpiece is to be turned at a feed rate of 0·12 mm/rev. The two tool materials to be analyzed are H.S.S. and carbide. The data for these two tool materials is as follows: 12

	Tool life (min.)	Cutting speed (m/min.)
H.S.S.	15	50
	40	25
Carbide	15	100
	50	75

H.S.S. costs an average of ₹ 50 per edge and carbide costs ₹ 115 per edge. The tool changing time is 2 min. and idle time is 3 min. Taking the machine running cost as ₹ 300 per hour, analyze for the selection of tool material based on the minimum cost of production and maximum production rate criterions.

(b) A single point right-hand cutting tool has tool signature in M.R.S. as 8 – 6 – 4 – 3 – 8 – 15 – 1.5 mm. Find inclination angle, orthogonal rake angle and orthogonal clearance angle in O.R.S. using master line method, check the answers analytically also. 8

[TURNOVER

Q.5. (a) Calculate and design a twist drill with Morse taper shank for machining a hole of dia. 32 H_7. The axial thrust force noted is 6550 N and torque is 72000 N-mm. Assume coefficient of friction between steel and steel as 0.096, half taper angle as 10^0 26' 16" and tolerance limit of the taper as 5'. 12

(b) Explain the profile design procedure of end mill type gear milling cutter. 8

Q.6. (a) During the Machining of C-20 steel with a 0-10-6-6-8-90-1mm ORS triangular carbide cutting insert the following observations have been made. 12

Cutting speed = 200 m/min,
Depth of cut = 1.2 mm,
Width of cut = 2 mm,
Feed = 0.2 mm/rev,
Chip thickness = 0. 4 mm,
Cutting force in cutting velocity direction = 1500N,
Feed force = 750 N,

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, (vi) Specific Cutting Energy and Power required for cutting in KW. .

(b) Explain the construction and working of a Milling dynamometer. 8

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