TE-II | Machine Science & Technology PROD

24-11-15

QP Code : 5603

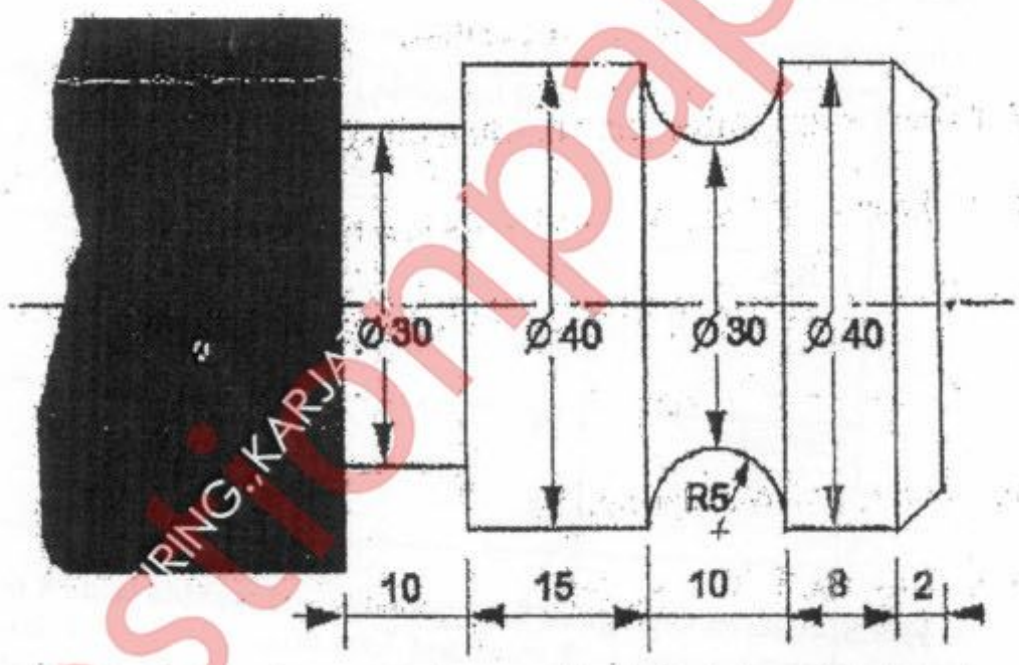
(3 Hours)

[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) Orthogonal and Oblique machining.
(b) NRS system of tool nomenclature.
(c) Sintered tungsten carbides.
(d) Rake angle variation for a twist drill.

Q.2. (a) Design a Flat form tool and sketch the form giving the dimensions of the profile. The shape is turned from a bar-stock of φ 45 mm. Data given: Rake angle= 12°, Clearance angle= 6°, Material of tool = H.S.S. 12



NOTE : ALL DIMENSIONS ARE IN mm.

(b) Derive an expression for optimum cutting speed and optimum tool life for minimum cost of production. Assume the tool life to follow Taylor's tool life equation. 8

[TURN OVER

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

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

(b) Calculate and design a round progressive broach for machining cylindrical hole of dia. $25H_7$ and axial length of 50 mm in a workpiece of carbon steel. Assume cut per tooth in the range of 0.02 to 0.06 mm and broaching force required per 'mm' of cutting edge length to be 120 N/mm. Broach is of H.S.S. and permissible stress not to exceed 300 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	40
	35	30
Carbide	15	140
	45	90

H.S.S. costs an average of ₹ 25 per edge and carbide costs ₹ 60 per edge. The tool changing time is 3 min. and idle time is 4 min. Taking the machine running cost as ₹ 240 per hour, analyze for the selection of tool material based on minimum cost of production and maximum production rate criterions.

(b) A single point cutting tool has tool signature in M.R.S. as 12 – 10 – 8 – 8 – 10 – 15 – 1 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

[TURN OVER

Q.5. (a) Calculate and design a gear hob for cutting a spur gear with pressure angle 20 deg., module = 5 mm and No. of teeth = 44. 12

(b) Write a short note on composition, properties and applications of H.S.S. and Tungsten carbide as cutting tool materials. 8

Q.6. (a) Following data was collected from an orthogonal machining test on steel, 12
Cutting speed = 125 m/min,
Rake angle = 100,
Width of cut = 2 mm,
Feed = 0.25 mm/rev,
Chip thickness = 0. 45 mm,
Cutting force in cutting velocity direction = 185 kgf.
Feed force = 75 kgf.
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 various wear mechanisms of cutting tools. 8