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No. of Printed Pages—5 **ME–504**

B. TECH.

FIFTH SEMESTER EXAMINATION, 2003-2004

MANUFACTURING SCIENCE–II

Time : 3 Hours *Total Marks : 100*

Note : (1) Attempt **ALL** questions.

(2) Symbols have their usual meaning. Assume missing data/information, if any.

1. *(a)* Answer any THREE of the following :— **(4×3=12)**

(i) During machining of C–40 steel, a double carbide cutting tool of back rake angle, $\alpha_b = 2^\circ 36'$, side rake angle, $\alpha_s = 9^\circ 36'$ and side cutting edge angle, $\gamma_s = 15^\circ$ has been used. Show that the machining is orthogonal.

(ii) What is meant by Built-up Edge ? Explain conditions which promote the growth of built-up edge along with its consequences.

(iii) What is meant by Machinability ? Explain the methods of representing the machinability.

(iv) If Taylor's tool life exponent $n = 0{\cdot}5$ and constant C=400, what will be the percentage increase in tool life when cutting speed is reduced by half ?

(v) A metal is being cut orthogonally with a tool with zero rake angles. Show that the rate of heat generation in the shear

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plane can be expressed as $F_c V(1-\mu r)$, where F_c is the principal cutting force, V is the cutting speed, μ is the coefficient of friction at the chip tool interface and r is the cutting ratio.

(b) During turning of mild steel by a single point cutting tool of specification 0°–10°–5°–6°–10°–60°–1mm (ORS) at a feed rate of 0·2 mm/rev. and depth of cut of 2 mm, a chip thickness of 0·4 mm was obtained. If for mild steel the dynamic shear strength $\tau_s = 74$ N/mm^2, find the three components of cutting forces. Assume the coefficient of friction at the chip tool interface as 0·78. (8)

2. Answer any FOUR of the following :— (5×4=20)

(a) Show that the maximum chip thickness t_{max} in slab milling operation is given by

$$t_{max} = \frac{2f\sqrt{d(D-d)}}{NZD},$$

where f is the table feed rate, N is the rpm, Z is the number of teeth in the cutter, D is the cutter diameter and d is the depth of cut.

(b) How does shaper differ from planer in terms of their operation and type of work pieces ?

(c) What is the importance of tool layout in automats ? What considerations one has to keep in mind while planning for a best tool layout ?

(d) Explain the constructional features of a dividing head used in milling. Also, explain the method for obtaining compound indexing.

(e) How does Reamer differ from Twist Drill ? With a neat sketch, describe geometry of a hand reamer.

(f) How is drill size designated ? Briefly explain.

3. (a) Answer any TWO of the following :— (5×2=10)

(i) What decides the hardness of the grinding wheel ? Distinguish between Dressing and Truing of grinding wheel.

(ii) What are the main differences between Cylindrical and Centerless grindings ?

(iii) What are the wear mechanisms of a grinding wheel ? Discuss in brief.

(iv) Distinguish between Honing and Lapping.

(b) Show that the maximum chip thickness t_m in surface grinding, using grinding wheel diameter D, is given by —

$$t_m = \frac{2V_t}{b\,CV_w}\sqrt{\frac{d}{D}},$$

where V_t is the table speed, C is the number of abrasive grains per unit area of the grinding wheel surface, V_w is the grinding wheel surface speed, b is the width and d is the depth of cut. (10)

4. Answer any FOUR of the following :— (5×4=20)

(a) Briefly describe the oxyacetylene welding equipments. Why is neutral flame extensively used in oxyacetylene welding ?

(b) How are coated electrodes for manual metal arc welding designated ? Explain in brief.

(c) What are the applications of the submerged arc welding and how is it different from the inert gas shielded metal arc welding process ?

(d) Briefly explain the projection welding process. Also, give its advantages and disadvantages.

(e) What is electroslag welding ? Giving sketches explain its working and field of applications.

(f) What are the different defects often found in a fusion welding ? Briefly explain them.

2.

5. Answer any FOUR of the following :— (5×4=20)

(a) What is Abrasive Jet Machining (AJM) Process ? Explain the effects of stand-off distance and abrasive grit size on material removal rate in the AJM.

(b) Explain the role of any *two* of the following in Electro-Discharge Machining process :—

(i) Dielectric media,

(ii) Capacitance of the circuit, and

(iii) Resistance of the circuit.

(c) Estimate the metal removal rate (in cc/hr) of an alloy containing 18% Cobalt, 62% Nickel and 20% Chromium during Electro-Chemical Machining (ECM) with a current of 500 Amperes. The density of the alloy is 8·28 gm/cc. The following data is available :—

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Metal	Gram Atomic Weight	Valency
Cobalt	58·93	2
Nickel	58·71	2
Chromium	51·99	6
Assume Faraday's Constant as 96,500 Coulombs / mole.		

(d) Giving neat sketch, explain the working of Ultrasonic Machining Process. Also, discuss its scope of applications.

(e) What is Electron Beam Welding (EBW) Process ? Describe, in brief, giving its scope of application.

(f) Giving neat diagram, explain the working of Laser Beam Machining Process.