Department of Mechanical Engineering
Birla Institute of Technology and Science, Pilani, Pilani campus

MF F316: Machining and Machine Tools

Comprehensive Examination (21/12/2023)

Time: 180 min; Max. Marks (MCQs+Subjective): 70

Multiple Choice Questions (Marks-10):

1. In up-milling, the thickness of chip is
(a) minimum at the beginning of the cut and maximum at the end of the cut
(b) maximum at the beginning of the cut and minimum at the end of the cut
(c) uniform throughout the cut
(d) none of these

2. Chip removal in brittle materials occur due to
(a) Yielding
(b) Crack propagation
(c) Both
(d) None of the above

3. In a milling operation feed per tooth is .002 mm and number of teeth is 30 rotating with 40 rpm. Feed per min in mm/min is equal to
(a) 3
(b) 4.3
(c) 2.4
(d) None of the above

4. With the passage of time, there is a loss in the weight of the tool, this phenomenon is known as:
(a) Thermal cracking
(b) Mechanical chipping
(c) Softening
(d) Gradual wear

5. The amount of heat generated in a turning operation is distributed in tool, workpiece and chip in ratio of
(a) 1:1:8
(b) 8:1:1
(c) 1:8:1
(d) None of the above

6. If rake angle = 0^0, angle of friction = 15^0, as per Lee & Shaffer model, shear angle will be
(a) 15^0
(b) 30^0
(c) 45^0
(d) 75^0

7. Chip flow on the rake face at elevated temperatures will lead to
(a) Crater wear
(b) Flank wear
(c) Loss of clearance angle
(d) All of the above

8. The process of changing the shape of the grinding wheel as it becomes worn due to breaking away of the abrasive and bond is called
(a) Truing
(b) Dressing
(c) Facing
(d) Clearing

9. The process of improving the cutting action of the grinding wheel is called as
(a) Dressing
(b) Facing
(c) Clearing
(d) Truing

10. Honing is mainly used for finishing
(a) Internal cylindrical surfaces
(b) Outer cylindrical surfaces
(c) Both (a) and (b)
(d) None of the above

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Note to Students:

1. This is a CLOSE BOOK test.
2. **Assumptions made if any, should be stated clearly at the beginning of your answer**.

Subjective Questions (Marks-60):

1. What are the various assumptions made during the calculation of forces in orthogonal cutting? **5**
2. How depth of cut and nose radius are interrelated in the turning process? What happens when the depth of cut is greater than the nose radius of the cutting tool? **5**
3. Explain the difference between overrun distance and approach distance with a diagram. Also, give the reason why the above-mentioned distances are needed during the milling operation. **5**
4. What are the basic elements of the machine tools? **5**
5. Explain the working principle of lapping operation with a diagram. Elaborate on the difference between the grinding process and the lapping process, and lastly, mention the characteristics of the lapping process. **10**
6. A workpiece of 20 mm width is being milled using a straight slab milling cutter with 20 teeth, 50 mm diameter, and 10^o radial rake. The feed velocity of the table is 20 mm/min, and the cutter rotates at 70 rpm. If a depth of cut of 1 mm is used, what will be the power consumption? Calculate the maximum torque due to one cutting tooth. Additionally, plot the milling torque fluctuations with respect to arbor rotation. (coefficient of friction: 0.4 and shear stress of workpiece: 500 N/mm^2) **15**
7. Determine the maximum temperature along the rake face of the tool when machining mild steel, given workpiece shear stress: 400 MPa, rake angle: 0^0, cutting velocity: 2 m/s, uncut thickness: 0.25 mm, width of cut: 2 mm, coefficient of friction: 0.5, density of material: 7200 Kg/m^3, thermal conductivity: 43.6 W/m-^{0}C, specific heat of material: 502 J/kg-^{0}C, initial temperature of workpiece (θ_o): 40^0C. Use Lee's and Shaffer's shear angle relationship only. **15**

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