Assignment 4

Due on [09-30-20, 2018 IE]

1. Select an appropriate machining process for the following materials:
   - Precipitation hardened tool steel (P20)
   - Free-cutting brass (C26000)
   - Inconel 718
   - Stainless steel (AISI 304)
   - Silicon steel

   Machining processes:
   - Turning
   - Drilling
   - Milling
   - Broaching
   - boring
   - Grinding
   - EDM
   - Wire cutting

   Choose the most suitable process for each material and justify your choice.

2. Explain the principles of EDM and wire cutting processes, including the different types of electrodes used and their characteristics.

3. A workpiece has a hole with a diameter of 10 mm. The hole is to be drilled using a CNC milling machine with a 10 mm diameter drill bit. Calculate the drilling time per hole, given the following information:
   - Spindle speed: 750 rpm
   - Feed rate: 0.1 mm/rev
   - Depth of cut: 3.0 mm
   - Tool life: 700 cycles
   - Number of holes: 10

   Use the following formulas:
   - Machining time (T) = Time per hole (T_h) x Number of holes (N)
   - Time per hole (T_h) = Spindle time (S) + Feed time (F)
   - Spindle time (S) = Depth of cut (D) / Spindle speed (n)
   - Feed time (F) = Depth of cut (D) x Feed rate (f)

4. A workpiece is to be machined using a turning operation. The workpiece has a length of 100 mm and a diameter of 20 mm. The cutting tool has a diameter of 10 mm and a length of 50 mm. The cutting speed is 50 m/min, and the feed rate is 0.1 mm/rev. Calculate the cutting force (FC) and the cutting power (Pc).

   Cutting force (FC) can be calculated using the following formula:
   - FC = πD x F x v / 4
   - Cutting power (Pc) can be calculated using the following formula:
   - Pc = FC x v / 1000

5. Design a fixture for a workpiece with dimensions of 100 mm x 50 mm x 25 mm. The fixture should be able to hold the workpiece securely during machining. Include all necessary design considerations and a detailed description of the fixture components.

6. A workpiece is to be machined using a grinding operation. The workpiece has a size of 100 mm x 50 mm x 25 mm. The grinding wheel has a diameter of 200 mm and a thickness of 25 mm. The grinding wheel is permissible at 1200 rpm. Calculate the grinding time per workpiece, given the following information:
   - Spindle speed: 1200 rpm
   - Feed rate: 0.1 mm/rev
   - Depth of cut: 3.0 mm
   - Number of workpieces: 10

   Use the following formula:
   - Grinding time (T_g) = (Depth of cut x Number of workpieces) / Feed rate

7. A workpiece is to be machined using a EDM process. The workpiece has a size of 100 mm x 50 mm x 25 mm. The EDM wire has a diameter of 0.1 mm and a length of 500 mm. The power supply voltage is 80 V, and the current is 1 A. Calculate the machining time per workpiece, given the following information:
   - Workpiece size: 100 mm x 50 mm x 25 mm
   - EDM wire diameter: 0.1 mm
   - EDM wire length: 500 mm
   - Power supply voltage: 80 V
   - Power supply current: 1 A
   - Number of workpieces: 10

   Use the following formula:
   - Machining time (T_m) = (Workpiece volume / (Wire diameter x Wire length x 1000)) x (Voltage x Current) / 1000