國立臺灣科技大學

九十一學年度碩士班招生考試試題

系所組別： 機械工程系在職專班

科　目： 機械工程實務

一、 問答題 (50%)

1. 請分別說明在傳動機構所使用之齒輪(Gear)及凸輪(Cam)之種類及其功能。(10%)

2. 流體機械中幫浦(Pump)之功能爲何？如何分類？又在幫浦運轉中有所謂孔蝕 ( Cavitation )及水鎚 (Water hammer) 現象，請分別說明之。(10%)

3. 在自動化系統中選擇油壓控制或氣壓控制之考慮因素爲何？各有何優劣點？又油壓技術及氣壓技術各包含哪些項目及裝置？(10%)

4. 請分別說明弛力退火(Stress-relief annealing)及完全退火(Full annealing)之目的及內容。(10%)

5. 非傳統加工中有所謂光化學切削(Photochemical machining)者，請說明其內容及應用情況。(10%)

二、 請將下列短文翻譯成中文 (50%)

1. Significant changes are taking place in the design of manufacturing systems, fueled by the following trends:
   (1). The implementation of manufacturing cells as the first step in just-in-time manufacturing will increase.
   (2). Proliferation of number and variety of products will continue, resulting in a decrease in quantities as variety increases.
   (3). The customers desire for closer tolerances (more precision, better quality), reduced cost, and on-time delivery will continue to increase.
   (4). Variety in materials, including composite materials with widely diverse properties, will continue to increase, causing further proliferation of the manufacturing processes.
   (5). The cost of materials, including materials handling and energy, will continue to be a major part of the total product cost, while direct labor will be 5 to 10 % of the total. That is, the number of direct laborers used in manufacturing will continue to decrease.
   (6). The time between design of a product and its manufacture will continue to decrease. (10%)

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2. The coefficient of friction is usually determined experimentally, either during actual manufacturing processes or in simulated tests using small-scale specimens of various shapes. The techniques used generally involve measurement of either forces or dimensional changes in the specimen.

   Because of difficulties involved in full-scale experimentation on production equipment, particularly the high cost of interrupting production, small-scale tests simulating actual production conditions have been developed and used extensively. Unfortunately, many of these tests do not duplicate the exact conditions of the actual metalworking process, such as size of workpiece and its surface condition, the force involved, and operating speed and temperature. They can, however, be used to compare different materials and lubricants. (10%)

3. Selective Laser Sintering uses a moving laser beam to sinter heat-fusible powders in areas corresponding to the CAD geometric model one layer at a time to build the solid part. After each layer is completed, a new layer of loose powders is spread across the surface using a counter-rotating roller. The powders are preheated to just below their melting point in order to facilitate bonding and reduce distortion. Layer by layer, the powders are gradually bonded to a solid mass that forms the three-dimensional part geometry. In areas not sintered by the laser beam, the powders remain loose so they can be poured out of the completed part. In the meantime, they serve to support the solid regions of the part as fabrication proceeds. Layer thickness is 0.075mm to 0.50mm. (10%)

4. Fatigue is the phenomenon of failure of a material under cyclic loading. It is a problem that affects any component or part that moves. Automobiles on roads, airplanes in the air, ships on the high sea constantly battered by waves, nuclear reactors and turbines under cyclic temperature conditions, and many others are examples of situations where fatigue behavior of material assumes a singular importance. It is known that failure under cyclic stress or strain occurs at a stress level much lower than that under condition of monotonic loading. It is estimated that 90% of service failure of component that undergo movement of one form or another can be attributed to the phenomenon of fatigue. (10%)

5. An important consideration in casting is the heat transfer during complete cycle from pouring to solidification and cooling to room temperature. Heat flow at different locations in the system is a complex phenomenon; it depends on many factors relating to the casting material and the mold and process parameters. For instance, in casting thin sections the metal flow rate must be high enough to avoid premature chilling and solidification. But, the flow rate must not be so fast as to cause excessive turbulence, with its detrimental effects on the casting process. (10%)