

國立臺灣科技大學

九十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. 請以流程圖說明逆向工程 (Reverse Engineering)。 (10%)
2. 何謂雷射 (LASER)? 雷射光有那些特性? 並畫圖說明雷射光束切割 (Laser beam cutting) 之工作原理。 (10%)
3. 請以流體力學觀點, 畫圖說明二維機翼剖面受到壓力及剪應力所形成的升力及阻力。 (10%)
4. 實用上最有名的控制器之一就是 PID 控制器, 其轉移函數為何? 欲設計一控制系統之 PID 控制器, 其步驟為何? (10%)
5. 請約略畫出共析鋼之恆溫變態圖 (Temperature-Time-Transformation diagram), 並在恆溫變態圖內描畫 (1) 爐中冷卻 (2) 空氣中冷卻 (3) 油中冷卻 (4) 水中冷卻的四種連續冷卻曲線, 並說明四種變態組織。 (10%)

二、請將下列短文翻譯成中文 (50%)

1. Tests on prototypes must be designed to simulate as closely as possible the conditions under which the product is to be used. These include environmental conditions such as temperature and humidity, as well as the effects of vibration and repeated use and misuse of the product. Computer-aided engineering techniques are now capable of comprehensively and rapidly performing such simulations. During this stage, modifications in the original design, material selected, or production methods may be necessary. After this phase has been completed, appropriate process plans, manufacturing methods, equipment, and tooling, are selected with the cooperation of manufacturing engineers, process planners, and all others involved in production. (10%)
2. The broad categories of processing methods for material are:
 - Casting (expendable mold and permanent mold).
 - Forming and shaping (rolling, forging, extrusion, drawing, sheet forming, powder metallurgy, and molding).
 - Machining (turning, boring, drilling, milling, shaping, broaching, grinding, ultrasonic machining, chemical machining, and high energy-beam machining).
 - Joining (welding, brazing, soldering, adhesive bonding, and mechanical joining).
 - Finishing operations (honing, lapping, polishing, burnishing, deburring, surface treating, coating, and plating). (10%)

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3. Thermal conductivity, in conjunction with thermal expansion, plays the most significant role in causing thermal stresses, both in manufactured components and in tools and dies. This particularly important in a forging operation, for example, when hot workpieces are placed over relatively cool dies, making the die surfaces undergo thermal cycling. To reduce thermal stresses, a combination of high thermal conductivity and low thermal expansion is desirable. Thermal stresses can lead to cracks in ceramics parts and in tools and dies made of relatively brittle materials. (10%)
4. The time-domain characteristics of a linear control system are represented by the transient and the steady-state responses of the system when certain test signals are applied. Depending on the objectives of the design, these test signals are usually in the form of a step function or a ramp function or other time-domain functions. For a step input. The percent maximum overshoot, rise time, and settling time are often used to measure the performance of the system. Qualitatively, the damping ration and the natural un-damped frequency can be used to indicate the relative stability of the system. (10%)
5. The following are the general types of materials used in manufacturing today either individually or in combination.
 - Ferrous metals (carbon, alloy, stainless, and tool and die steels).
 - Nonferrous metals and alloys (aluminum, copper, refractory metals, zirconium, and precious metals).
 - Plastics (thermoplastics, thermosets, and elastomers).
 - Ceramics, glass ceramics, glasses, graphite, and diamond.
 - Composite materials (reinforced plastics, metal-matrix and ceramic-matrix composites, and honeycomb structures).These are also known as engineered materials. (10%)



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