

國立交通大學機械系碩士班招生考試試題紙

系 所 組 別	考 試 科 目 (中 文 名 稱)	考 試 日 期	備 註
機械工程系	車輛動力學	4 月 22 日 第 三 節	1. 試題共兩頁 2. 可用計算機

註：考生可否攜帶計算機或其他資料作答，請在備註欄註明（如未註明，一律不准攜帶）

1. **(15%)** A straight running vehicle, when subjects to a side force (i.e crosswind) acting at vehicle C.G (center of gravity), what is the response of this vehicle if the vehicle cornering characteristics is understeer (US), neutral steer (NS) and oversteer (OS) respectively.

2. **(15%)** What is the function of the pressure proportional valve in vehicle braking system? What will happen if the front tires and the rear tires are locked respectively in braking?

3. **(20%)** Explanation
 - a. Understeer, Neutral Steer, Oversteer (10 %)
 - b. Critical Speed (in cornering), V_{crit} (5 %)
 - c. Tire Slip Angle, α (5%)

4. **(15%)** A first order system is shown in Fig.1a. Please set up the transfer function between its output voltage e_o and its input voltage e_i by Kirchoff's Loop law and use the operator $D=d/dt$ to establish the block diagram as shown in Fig. 1b.
 - (a) Explain the meaning of K and τ . Please also show the time response of the output voltage e_o with the step-input voltage e_i (5%)
 - (b) If you want to increase the response speed, how are you going to adjust? (5%)
 - (c) Replace the position of resistor R and capacitor C , what will be the difference? Please state what you can use with this circuit in the frequency domain signal processing. (5%)

5. **(15%)** A permanent magnet DC motor controlled by the current flow into the armature drives the external rotational load as shown in Fig.2.
 - (a) Please set up the related dynamic equations between the load torque T_i ,

motor speed ω_o , and input voltage e_i . (8%)

- (b) Explain the effects of parameters B and J on the response of load T_i and input voltage e_i to the motor speed ω_o where B is the damping coefficient and J is polar moment of inertia. (7%)

6. (20%) A field controlled DC motor drives the external load as shown in Fig. 3. In the system block diagram, please establish the parameters τ_L , K_{T_i} , K_e with related resistance, inductance, damping coefficient B and polar moment of inertia J . From the equation established, please combine this block diagram to form the transfer function between the motor speed ω_o , the torque T_i and the input voltage e_i .

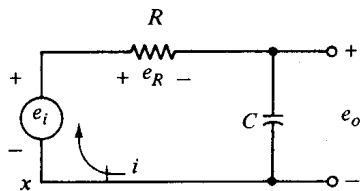


Fig. 1a

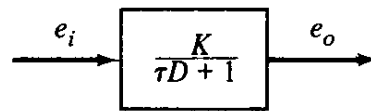
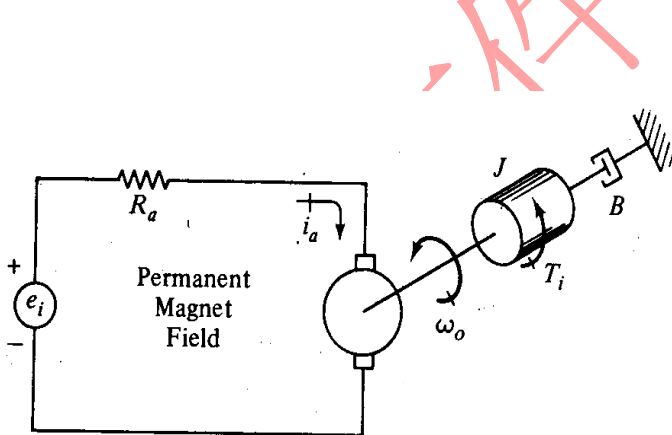
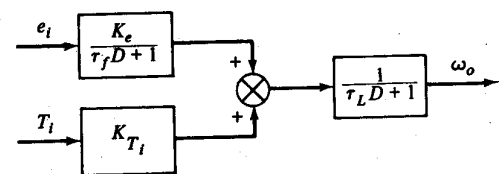
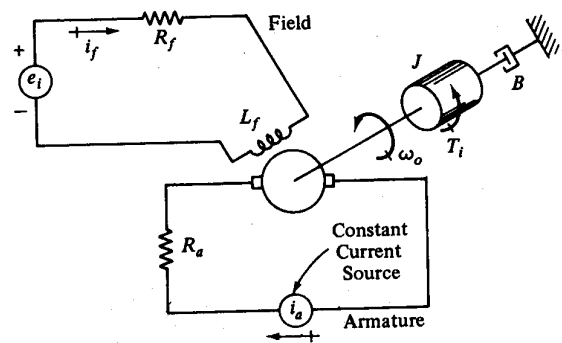


Fig. 1b



DC Motor and Load

Fig. 2



Field-Controlled DC Motor and Load

Fig. 3