PME 3433 Machine Design EXAM #5 Jan. 08, 2016

(Closed book)

一、(1)本學期機械設計專題之設計目標為何？(5%)

(2)請以流程圖說明要完成設計目標需有哪些工作項目？(10%)

(3)請繪圖說明換檔機構的大致形狀及操作方式，以及其組成零組件大致有哪些？(5%)

二、當我們使用動力螺桿(Power screw)之千斤頂，舉起或降低物件時分別以公式(a)及(b)來表示，請問甚麼叫做Self-locking (自鎖)現象？(5%) 從公式中找出產生自鎖現象的條件？(5%)

|  |  |
| --- | --- |
|  |  |
| (a) | (b) |

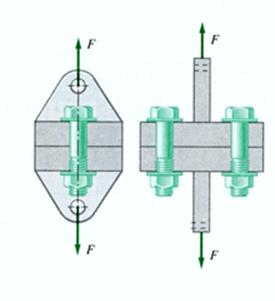
三、What is the difference between a deep-grove ball bearing and an angular-contact ball bearing? (5%) The following figure shows the angular-contact ball bearings are in back-to-back arrangement with preload, what is the purpose of the preload? (5%)

|  |
| --- |
|  |
| Top figure: Individually as manufactured  Bottom figure: as mounted with preload. |

四、A deep-grove ball bearing has the basic load rating of 3 kN, the rated speed of 500 rpm and rated life of 3000 hours. If this bearing is designed to support a radial load of 1200 N and with the speed of 400 rpm, what is the L10 life of the bearing? (10%)

五、下圖所示為一用螺栓將二元件鎖固的螺栓接頭，用以支撐一外力F = 10kN。該接頭之螺栓彈簧率（Spring Rate）為Kb，元件之彈簧率為螺栓的4倍，即Km = 4Kb。請決定至少要加多少預力（Preload）於螺栓上以確保該螺栓的最大根部（Root）應力小於65%的降伏強度（Yield Strength），且該螺栓接頭不會分離。另，螺栓的降伏強度為240MPa，不考慮螺栓根部的應力集中影響。(25%)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 粗螺牙系列(Coarse Thread Series) | | | |
| Major  Diam.  d, mm | Pitch  p, mm | Minor  Diam.  dr, mm | Minor  Diam.  Area Ar，  mm2 | Tensile  Stress  Area2,  mm2 |
| 3.0 | 0.50 | 2.459 | 4.75 | 5.18 |
| 3.5 | 0.60 | 2.850 | 6.38 | 6.98 |
| 4.0 | 0.70 | 3.242 | 8.25 | 9.05 |
| 5.0 | 0.80 | 4.134 | 13.4 | 14.6 |
| 6.0 | 1.00 | 4.917 | 19.0 | 20.7 |
| 8.0 | 1.25 | 6.647 | 34.7 | 37.6 |
| 10.0 | 1.50 | 8.376 | 55.1 | 59.5 |
| 12.0 | 1.75 | 10.106 | 80.2 | 86.3 |
| 14.0 | 2.00 | 11.835 | 110 | 118 |
| 16.0 | 2.00 | 13.835 | 150 | 160 |



六、(1) Partial Bearing與full bearing不同在哪裡？採用partial bearing的原因為何? (5%)

(2) 液靜壓軸承(Hydrostatic bearing)之工作原理。(5%)

(3) 滾珠軸承的彈液動潤滑(Elasto-hydrodynamic lubrication)之工作原理。(5%)

七、下圖所示為液動軸承之摩擦係數與運轉特性之關係，若將該曲線分成三個區域，即AB、BC、CD；請說明該三個區域的潤滑特性。(10%)

