

國立成功大學

113學年度碩士班招生考試試題

編 號：67

系 所：機械工程學系

科 目：動力學及專業英文

日 期：0201

節 次：第 2 節

備 註：可使用計算機

※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. [25%] The gear is defined as a toothed member designed to transmit motion to or receive motion from another toothed member, by means of successively engaged teeth. The two gears are rotatable around axes whose relative positions are fixed, and they form a gear pair. The torque from the driving shaft to the driven one in a gear drive is transmitted due to the pressure of the teeth of the pinion (the gear in a pair which has the smaller number of teeth) on those of the wheel (the gear in a pair which has the greater number of teeth). To preserve a constant transmission ratio, the teeth of both pinion and wheel should have conjugate profiles.

Parallel and co-planer shafts connected by gears are called spur gears. Spur gears have straight teeth and are parallel to the axis of the wheel. The advantages of spur gears are their simplicity in design, and economy of manufacture and maintenance. Spur gears are known as slow speed gears. If noise is not a serious design problem, spur gears can be used at almost any speed.

Helical gears have their teeth inclined to the axis of the shafts in the form of a helix. These gears are usually thought of as high-speed gears. Helical gears can take higher loads than similarly sized spur gears. The motion of helical gears is smoother and quieter than the motion of spur gears.

Intersecting but coplanar shafts connected by gears are called bevel gears. Straight bevel gears can be used on shafts at any angle, but right angle is the most common. Bevel gears can be used to change the direction of drive in a gear system by 90 degrees.

(a) Define a gear in your own words.

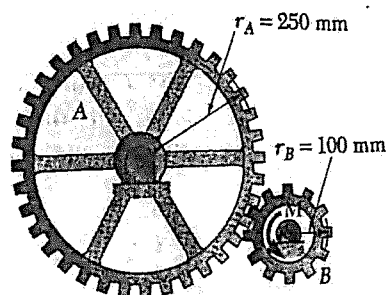
(b) Name and describe the characteristics of the gear type mentioned in Paragraph 2.

(c) Explain the primary advantages of helical gears mentioned in Paragraph 3.

(d) What are bevel gears typically used for, and what angle is most commonly associated with their application?

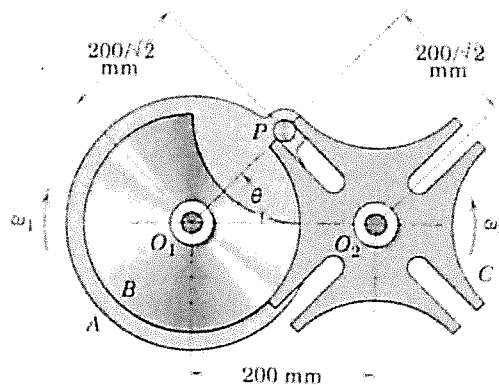
(e) What is the primary advantage of using helical gears over spur gears in high-speed applications?

2. [25%] Gear A has a mass of 10 kg and a radius of gyration of 200 mm, and gear B has a mass of 3 kg and a radius of gyration of 80 mm. The system is at rest when a couple M of magnitude 6 N·m is applied to gear B. Neglecting friction, determine (a) the number of revolutions executed by gear B before its angular velocity reaches 600 rpm, (b) the tangential force which gear B exerts on gear A.



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3. [25%] The Geneva wheel is a mechanism for producing intermittent rotation. Pin P in the integral unit of wheel A and locking plate B engages the radial slots in wheel C , thus turning wheel C one-fourth of a revolution for each revolution of the pin. At the engagement position shown, $\theta=45^\circ$. For a constant clockwise angular velocity $\omega_1=2$ rad/s of wheel A , determine the corresponding counterclockwise angular velocity ω_2 of wheel C for $\theta=20^\circ$.



4. [25%] The robotic device consists of the stationary pedestal OA , arm AB pivoted at A , and arm BC pivoted at B . Member AB is rotating about joint A with a counterclockwise angular velocity of 2 rad/s, and this rate is increasing at 4 rad/s². Determine the moment M_B exerted by arm AB on arm BC if joint B is held in a locked condition. The mass of arm BC is 4 kg, and the arm may be treated as a uniform slender rod.

