

Total No. of Questions : 10]

SEAT No. :

P3477

[Total No. of Pages : 3

[5560]-113

T.E. (Mechanical) (Mechanical S/W & Automobile)

THEORY OF MACHINES - II

(2012 Pattern) (Semester - I)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Answer all questions.*
- 2) *Figures to the right indicate full marks.*

Q1) a) Derive an expression for length of path contact of involute gears. **[6]**

- b) Two helical gears having gear ratio of 4 and normal module 8 mm with normal pressure angle 20° and helix angle 28° . If the centre distance is approximately 650 mm apart, determine the number of teeth on each gear and the exact center distance. **[6]**

OR

Q2) a) A pinion is to mesh with rack, equal pinion and a gear wheel with the gear ratio 3:1. If the pressure angle is 20° and standard addendum of one module is to be used, find the minimum number of teeth on the pinion in all three cases, if interference is to be avoided. **[6]**

- b) Derive an expression for velocity ratio and center distance for worm gear drive. **[6]**

Q3) The arm of an simple epicyclic gear train rotates at 100 rpm in anticlockwise direction. The arm carries two wheels A and B having 36 and 45 teeth respectively. The wheel A is fixed and arm rotates about the center of wheel A. Draw the sketch and find the speed of wheel B. What will be the speed of B, if the wheel A instead of being fixed, makes 200 rpm clockwise? **[8]**

OR

- Q4) a)** Explain in detail with neat sketch compound epicyclic gear train. **[6]**
b) Explain difference between gear box and gear train. **[2]**

P.T.O.

- Q5) a)** Explain with neat sketch positively infinitely variable drive (PIV) [6]
- b)** A ship is pitching through an angle of 12° and the motion is simple harmonic. A complete oscillation takes 30 seconds. The turbine rotor rotates at 2000 rpm and it has mass moment of inertia of 7200 Kg-m^2 . If the rotor rotates in anticlockwise direction when viewed from the stern find the following
- 1) Magnitude of maximum gyroscopic couple and state its effect.
 - 2) Maximum angular acceleration of the ship during pitching. [10]

OR

- Q6) a)** Describe in brief continuous variable transmission (CVT) with a neat sketch. [6]
- b)** A two wheeler and a rider has a mass of 250 Kg. When the vehicle is upright their combined center of gravity is at 0.6m above the ground level. Each road wheel of a motor cycle has a mass moment of inertia of 1.5 Kg-m^2 and that for rotating parts of the engine is 0.25 Kg-m^2 the speed of the engine is 5 times the speed of the wheels and in the same direction. Find the angle of heel if the vehicle is travelling at 50 Km/hr and taking a turn of 30m. Take wheel diameter 0.6 m. [10]
- Q7) a)** Design a slider crank mechanism to coordinate three positions of input and output links for the following data by inversion method.
 $\theta_{12} = 30^\circ$, $\theta_{13} = 60^\circ$, $S_{12} = 40 \text{ mm}$, $S_{13} = 96 \text{ mm}$ and eccentricity = 20 mm [10]
- b)** Explain the following terms
1. Function generation
 2. Path generation
 3. Motion generation [6]

OR

- Q8) a)** Determine three angular positions of input and output links for the function $y = 2x^3 - x$ for a range $0 \leq x \leq 4$ and $\Delta\theta = 45^\circ$ and $\Delta\phi = 90^\circ$. Use Chebyshev spacing formula. [10]
- b)** Write short note on
1. Type synthesis
 2. Number synthesis
 3. Dimensional synthesis [6]

Q9) a) What is polynomial cam and where it is used? [2]

- b) Draw the profile of the cam to raise a valve with S.H.M. through 40 mm in $1/4^{\text{th}}$ of revolution keep it fully raised $1/10^{\text{th}}$ revolution and to lower it with uniform acceleration and retardation in $1/6^{\text{th}}$ revolution. The valve remains closed during the rest of the revolution. The diameter of roller is 20mm and minimum radius of the cam is to be 30 mm. The axis of the valve rod passes through the axis of the cam shaft. The cam shaft rotates at 360 rpm clockwise. Determine maximum velocity and maximum acceleration of the follower during the outstroke and return stroke. [16]

OR

Q10)a) What is cam jump phenomenon? What are possible ways to avoid that? [6]

- b) A cam rotation with uniform speed is required to the following motion to a knife edge follower:

- The outstroke of the follower is 40 mm for 60° of cam rotation.
- Dwell period for the next 30° of cam rotation.
- The return stroke during next 60° of cam rotation.
- Dwell for the remaining 210° of cam rotation.

The maximum radius of the cam 50 mm. The follower moves with uniform velocity for both outstroke and return stroke. Draw the cam profile when the follower passes through the axis of cam shaft and also determine maximum velocity during the outstroke and return stroke. [12]

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