SEAT No. :

[Total No. of Pages : 4

[5253]-113

T.E. (Mechanical/Automobile Engg./Mech. - S/W)
THEORY OF MACHINES - II
(2012 Pattern) (Semester - I)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:
  1)   *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.*
  2)   *Neat diagrams must be drawn wherever necessary.*
  3)   *Figures to the right side indicate full marks.*
  4)   *Assume suitable data if necessary.*

Q1) a)   Compare the cycloidal and involute gear tooth profiles.   **[6]**

  b)   Two involute gears of 20° pressure angle are in mesh. The speed of smaller gear is 1400 r.p.m. The number of teeth on pinion is 20 and gear ratio is 2.5. If the addendum of pinion and wheel is standard and equal to one module and module is 5 mm. find;   **[6]**

   i)   Length of path of contact.

   ii)   Contact ratio.

   iii)   Velocity of sliding at instant of contact ceases.

<div align="center">OR</div>

Q2) a)   A spiral gear drive, connecting two shafts, the approximate centre distance is 400 mm and the speed ratio = 2.5. The angle between the two shafts is 50° and the normal pitch is 20 mm. The spiral angle for the driving and driven wheels are equal. Find: **[6]**

   i)   Number of teeth on each wheel.

   ii)   Exact centre distance.

   iii)   Efficiency of the drive, if friction angle = 6°.

P.T.O.

b) A two start worm rotating at 950 rpm drives a 26 teeth worm gear. The worm has pitch diameter of 54 mm and a pitch of 20 mm. If the coefficient of friction is 0.06, find **[6]**

   i) The helix angle of the worm.

   ii) The centre distance.

   iii) The lead angle of maximum efficiency and maximum efficiency.

Q3) Fig.1 shows a gear train in which gear A is fixed. All the bevel gears of the system are identical. If the shaft I carrying the gear B on the arm as shown rotates at 1000 rpm in the counter clockwise direction as shown, determine the speed and direction of rotation of the shaft II. **[8]**
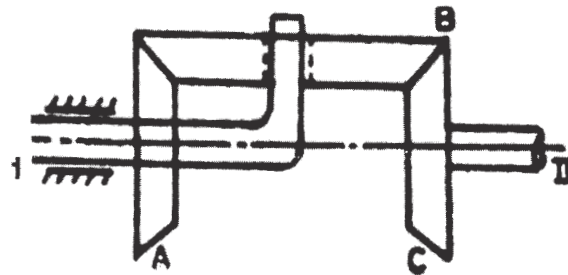

Figure 1

OR

Q4) Explain the following terms with the help of a neat sketch: **[8]**

a) Compound and Reverted gear train.

b) Differential gear box.

Q5) a) What are the various methods of steeples regulation of speed and feed rate. Explain any one system with neat sketch. **[6]**

b) An automobile car is travelling along a curved track of 200 m mean radius. Each of the four road wheels has a mass of 80 kg with a radius of gyration of 0.4 m. The rotating parts of the engine have a mass moment of inertia of 10 kg-m². The crank shaft rotates in the same direction as the road wheels. The gear ratio of the engine to the back wheels is 5:1.

The vehicle has a mass of 3000 kg and its C.G. is 0.5 m above the road level. The width of track of vehicle is 1.5 m. Calculate the limiting speed of the vehicle around the curve for all wheels to maintain contact with the road surface. The effective radius of wheels is 0.40 m. **[10]**

OR

Q6) a) Write short note on variators with axially displaceable cones. **[6]**

b) The turbine rotor of a ship has a mass of 2000 kg and rotates at a speed of 3000 r.p.m. clockwise when looking from a stern. The radius of gyration of the rotor is 0.5 m. **[10]**

Determine the gyroscopic couple and its effects upon the ship when the ship is steering to the right in a curve of 100 m radius at a speed of 16.1 knots. Calculate also the torque and its effects when the ship is pitching in simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 50 seconds and the total angular displacement between the two extreme positions of pitching is 12°. Find the maximum acceleration during pitching motion.

Q7) a) Explain the following terms related to kinematic synthesis **[3]**

i) Type synthesis

ii) Number synthesis and

iii) Dimensional synthesis.

b) Synthesize a four-bar mechanism to generate a function y = sin x for $0 \leq x \leq 90°$. The range of the output crank may be chosen as 60° while that of input crank be 120°. Assume three precision points which are to be obtained from Chebyshev spacing. Assume fixed link to be 52.5 mm long and $\theta_1 = 105°$ and $\phi_1 = 66°$. **[13]**

OR

Q8) a) Design a four bar mechanism to co-ordinate the input and output angles as follows: **[6]**

Input angles = 15°, 30° and 45°;

Output angles = 30°, 40° and 55°.

Take the length of input link equal to one unit.

b) Synthesis a slider crank mechanism by the method of inversion for its three positions $\theta_{12} = 20°$, $\theta_{13} = 50°$ of crank and corresponding three positions of slider $S_{12} = 18$ mm, $S_{13} = 48$, eccentricity is 15 mm and horizontal distance between fixed point and initial position of slider is 70 mm, when crank rotates in anticlockwise direction, find length of crank and connecting rod. **[10]**

Q9) It is required to set out the profile of a cam with oscillating follower for the following motion: **[18]**

a) Follower to move outward through an angular displacement of $20°$ during $90°$ of cam rotation ;

b) Follower to dwell for $45°$ of cam rotation;

c) Follower to return to its original position of zero displacement in $75°$ of cam rotation

d) Follower to dwell for the remaining period of the revolution of the cam.

The distance between the pivot centre and the follower roller centre is 70 mm and the roller diameter is 20 mm. The minimum radius of the cam corresponds to the starting position of the follower. The location of the pivot point is 70 mm to the left and 60 mm above the axis of rotation of the cam. The motion of the follower is to take place with S.H.M. during out stroke and with uniform acceleration and retardation during return stroke.

OR

Q10) a) Write short note on Jump phenomenon in cam system and obtain an expression for jump speed for eccentric cam operating a flat face follower. **[8]**

b) What do you mean by Advanced Cam Curves? Explain 3-4-5 polynomial curve. **[4]**

c) Derive expressions for displacement for circular arc cam operating a flat faced follower, When the contact is on the flank. **[6]**

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