Savitribai Phule Pune University
T.E. Production (Course - 2015)
Kinematics of Manufacturing Machines (311084)
Exam May 2018

Time: 3 Hours   *Max. Marks : 70*

Instructions to the candidates:
  1) *Answer Q1or 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) Describe the scope of body guidance in design of complex mechanisms.   **[5]**

     b) Derive an equation for efficiency of worm gearing.   **[5]**

OR

Q2) a) Using Freudenstein's equation, synthesize a four bar mechanism to co-ordinate   **[6]**
         crank and rocker displacement as follows:

Position	Crank angle	Rocker angle
1	30°	45°
2	45°	60°
3	60°	90°

     b) Compare cycloidal and involute tooth profile. Which one is more suitable for   **[4]**
         half nut mechanism of lathe?

Q3) a) What is importance of holding torque in epicyclic gear trains?   **[4]**

     b) Find the length of path of contact and length of arc of contact when the pinion   **[6]**
         with 20 teeth meshes with the annular wheel of 70 teeth on its inside. The
         addenda of the pinion and the wheel are 8 mm and 4 mm respectively. Pressure
         angle is 20° and module is 6 mm. Also find the number of pair of teeth in
         contact.

OR

Q4) a) How law of gearing is satisfied in cycloidal gear?   **[4]**

     b) A gear train is to be develop for driving a clock (to drive hour, minute and   **[6]**
         second hand) out of following available gears: A = 12 teeth, B = 14 teeth, C = 24
         teeth, D = 28 teeth, E = 36 teeth and F = 56 teeth.

         Develop a suitable compound gear train and draw its sketch.

Q5) a) What is the function of the flywheel? How does it differ from that of a governor? Also prove that **[8]**

Energy stored in flywheel = mean kinetic energy × 2 × coefficient of fluctuation of speed.

b) Following particulars refers to a constant acceleration cam and roller follower system: **[8]**

Minimum radius of cam = 25 mm	Roller radius = 10 mm
Lift of the follower = 25 mm	Angle of outstroke = 60°
Angle of outer dwell = 40°	Angle of return stroke = 120°

Draw the cam profile.

OR

Q6) a) A machine punching 40 mm diameter hole 30 mm thick plate does 0.119 N-m work per square mm of sheared area. The actual punching takes one second and the punch punches 1 hole in every 10 seconds. The maximum speed of the flywheel at its radius of gyration is 30 m/s. find the mass of the flywheel, if the speed is not to fall below 27 m/s during each punch. **[8]**

b) Analyze the cam and follower for velocity and acceleration, when follower moves with uniform velocity and acceleration during inward and outward stroke. **[8]**

Q7) a) What is need of balancing in high speed engines? Describe the function of balancing machines. **[6]**

b) In an inside cylinder locomotive the cylinder center lines are 0.7 m apart and has a stroke of 0.6 m. The rotating masses per cylinder are equivalent to 150 kg at the crank pin, and the reciprocating masses per cylinder to 180 kg. The wheel center lines are 1.5 m apart. The cranks are at right angles. **[10]**

The whole of the rotating and 2/3 of the reciprocating masses are to be balanced by masses placed at a radius of 0.6 m. Find the magnitude and direction of the balancing masses.

Find variation of tractive effort and the magnitude of swaying couple at a crank speed of 300 r. p. m.

OR

Q8) a) Why reciprocating masses can only partially balanced? Discuss partial balancing of inside cylinder locomotives. **[8]**

b) Four masses P, Q, R, and S revolve at equal radii and are equally spaced along a shaft. The mass Q is 7 kg and the radii of R and S makes an angle of 90° and 240° respectively with the radius of Q. find the magnitude of all other masses and the angular position of P so that the system may be completely balanced. **[8]**

Q9) a) What are the causes of undesirable vibrations in a CNC machine? How can you reduce the effect of those vibrations? **[8]**

b)   A mass suspended from a helical spring vibrates in a viscous fluid medium whose resistance varies directly with the speed. It is observed that the frequency of damped vibration is 90 per minute and that the amplitude decreases to 20% of its initial value in one complete vibration. Find the frequency of the free undamped vibration of the system. **[10]**

OR

Q10) a)   More vibrations are observed in old vehicles. What are the reasons for those vibrations? What remedial action will you take? **[6]**

b)   Define **[6]**
   i.   critical damping coefficient
   ii. damping factor
   iii. logarithmic decrement

c)   Write a short note on whirling speed of the shaft. **[6]**

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