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Question Paper Code : 10408

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2012.

Third/Fourth Semester

Mechanical Engineering

ME 2203/113302/ME 35/10122 ME 404/ME 1202/080120010 — KINEMATICS OF MACHINERY

(Common to PTME 2203 – Kinematics of Machinery for B.E. (Part-Time) Third Semester Mech. - Regulations 2009)

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Sketch and define Transmission angle of a four-bar mechanism. What are the worst values of transmission angle?

2. What is the condition for correct steering of an automobile?

3. What is a configuration diagram? What is its use?

4. Define rubbing velocity in a pin joint and write the equation for calculating the same.

5. Which type of cam follower motion is used in high speed engines? Why?

6. Why large pressure angle is not preferred in cam curves?

7. Define the following terms used in Gear
   (a) Pressure angle
   (b) Module.

8. What are the roles of "Idlers" in gear trains?

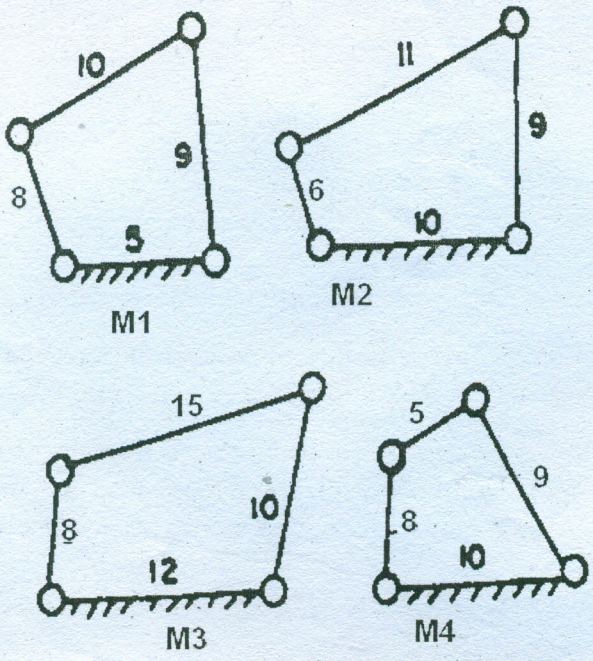
9. Differentiate between self locking and overhauling of screw.

10. State the functional difference between a clutch and a brake.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain Kutzbach criterion for the mobility of a mechanism with suitable example. (4)

(ii)



Dimensions are in cm

M1, M2, M3 and M4 are four-bar linkages as shown in figure. The numbers on the figure indicate the respective link lengths in cm. Identify the nature of the mechanism, i.e. whether double crank, crank rocker or double rocker. Give reasons in brief. (4 × 3 = 12)

Or

(b) (i) Explain, with a neat sketch, how an offset slider crank mechanism can be used as a quick-return motion mechanism. Derive an expression to find the quick-return ratio. *(10)*

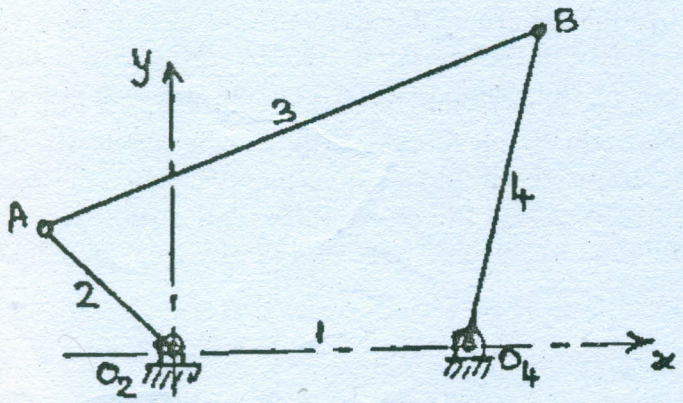
(ii) With a suitable diagram, explain how a pantograph works. What are its uses? (6)

12. (a) A four bar chain is represented by a quadrilateral ABCD in which AD is fixed and is 0.6 m long. The crank AB = 0.3 m long rotates in a clockwise direction at 10 rad/s and with an angular acceleration of 30 rad/s^2, both clockwise.

The crank drives the link CD (= 0.36 m) by means of the connecting link BC (= 0.36 m). The angle BAD = 60°. Using graphical method, determine the angular velocities and angular accelerations of CD and BC. (16)

Or

(b)



A four-bar mechanism, with O_2A as the input link, is shown in figure.

(i) Using analytical method, derive the equations for the angular velocity of the output link and of the connecting link AB. (8)

(ii) If the coordinates of the pin joints are $O_2(0,0)$, A (–15, 26), B(75, 70) and $O_4(50, 0)$ and the input link rotates at 2 rad/s counter-clockwise, find the angular velocities of AB and of O_4B. (8)

13. (a) A cam is to be designed for a knife edged follower with the following data:

(i) Follower lift is 40 mm with SHM, during 90° of cam rotation

(ii) Dwell for the next 30°

(iii) Follower return to its original position with SHM, during next 60° of cam rotation

(iv) Dwell for the remaining cam rotation.

The line of stroke of the follower passes through the axis of the cam shaft. Radius of the base circle of the cam is 40 mm.

(1) Draw the displacement diagram. (4)

(2) Draw the profile of the cam. (8)

(3) Determine the maximum velocity and acceleration of the follower during forward and return strokes, if the cam rotates at 200 rpm in CW direction. (4)

Or

(b) The following particulars relate to a symmetrical circular cam operating a flat faced follower : Least radius = 25 mm, Nose radius = 8 mm, Lift of the valve = 10 mm, Angle of action of cam = 120°, Cam shaft speed = 1000 r.p.m.

(i) Find the flank radius. (4)

(ii) Determine the maximum values of velocity, acceleration and retardation of the follower. (3)

(iii) Draw the profile of the cam. (9)

14. (a) (i) Two unequal gears of involute profile are to give required gear ratio. Derive an expression for the minimum number of teeth required for the pinion in order to avoid interference. (12)

(ii) Two gear wheels mesh externally to give a velocity ratio of 3 to 1. The involute teeth has 6 mm module and 20° pressure angle. Addendum is equal to one module. Determine the number of teeth on pinion to avoid interference and the corresponding number on the wheel. (4)

Or

(b) A reverted compound gear train is used as back gear of a lathe. It is required to give a reduction from cone-pulley speed to spindle speed of approximately 9 to 1. The module of the teeth on the high-speed pair is 4 mm and of those on low-speed pair is 5 mm. The centre distance is 180 mm. Determine the number of teeth on each of the four wheels, if the pinions are to have as nearly as possible equal numbers of teeth. Also sketch a line diagram and show the gear train. (16)

15. (a) (i) A single plate clutch, with both sides effective, has outer and inner diameters 300 mm and 200 mm respectively. The maximum intensity of pressure at any point in the contact surface is not to exceed 0.1 N/mm^2. If the coefficient of friction is 0.3, determine the power transmitted by a clutch at a speed 2500 rpm for two types of assumptions, that is, for uniform pressure and for uniform wear. (10)

(ii) The following data related to a screw jack; Pitch of the thread screw = 8 mm, diameter of the screw thread = 40 mm, Coefficient of friction between screw and nut = 0.1, load = 20 kN. Assuming that the load rotates with screw, determine :

(1) the ratio of torques required to raise and lower the load.

(2) the efficiency of the machine. (6)

Or

(b) (i) Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 2.1 m apart and are connected by a belt, as a cross belt drive. The larger pulley rotates at 225 r.p.m. The maximum permissible tension in the belt is 1 kN and the coefficient of friction between the belt and the pulley is 0.25. Find the power that can be transmitted. (8)

(ii) In a simple band brake, one end of the band is attached to the fulcrum of a lever. The other end is attached at a distance of b from the fulcrum. The effort is applied at the end of the lever. Derive an expression for braking torque, in terms of the effort. (8)
