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Question Paper Code : 23571

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fourth Semester

Mechanical Engineering

ME 1252/070120014 — KINEMATICS OF MACHINERY

(Common to Third Semester, Mechactronics Engineering)

(Regulation 2004/2007)

(Also common to B.E. (Part-Time) Semester for Mechanical Engineering, Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define degree of freedom of a mechanism.

2. What is the condition for obtaining rocker-rocker mechanism from a 4-bar chain?

3. State what is meant by 'Coriolis Acceleration'.

4. During velocity analysis of a reciprocating engine mechanism, explain the. method to find the direction of the angular velocity of the connecting rod?

5. In context with Cam, define Pitch point.

6. What is high speed cam?

7. Name two curves for use as gear profile, which satisfy the law of gearing.

8. What is a 'Worm gear drivel Explain with a sketch.

9. State the law of belting.

10. Differentiate between a brake and a clutch.

PART B — (5 × 16 = 80 marks)

11. (a) (i) In a whitworth quick return mechanism, driving crank is 15 cm long. The distance between the fixed center is 10 cm. The line of stroke of ram passes through the center of rotation of slotted lever, whose free end is connected to the ram by a connecting link.

Determine the ratio of time of cutting to time of return. (8)

(ii) Determine the number of degree of freedom of the following mechanisms, shown in the Fig. Q.11(a) (ii). (4 x 2 = 8)

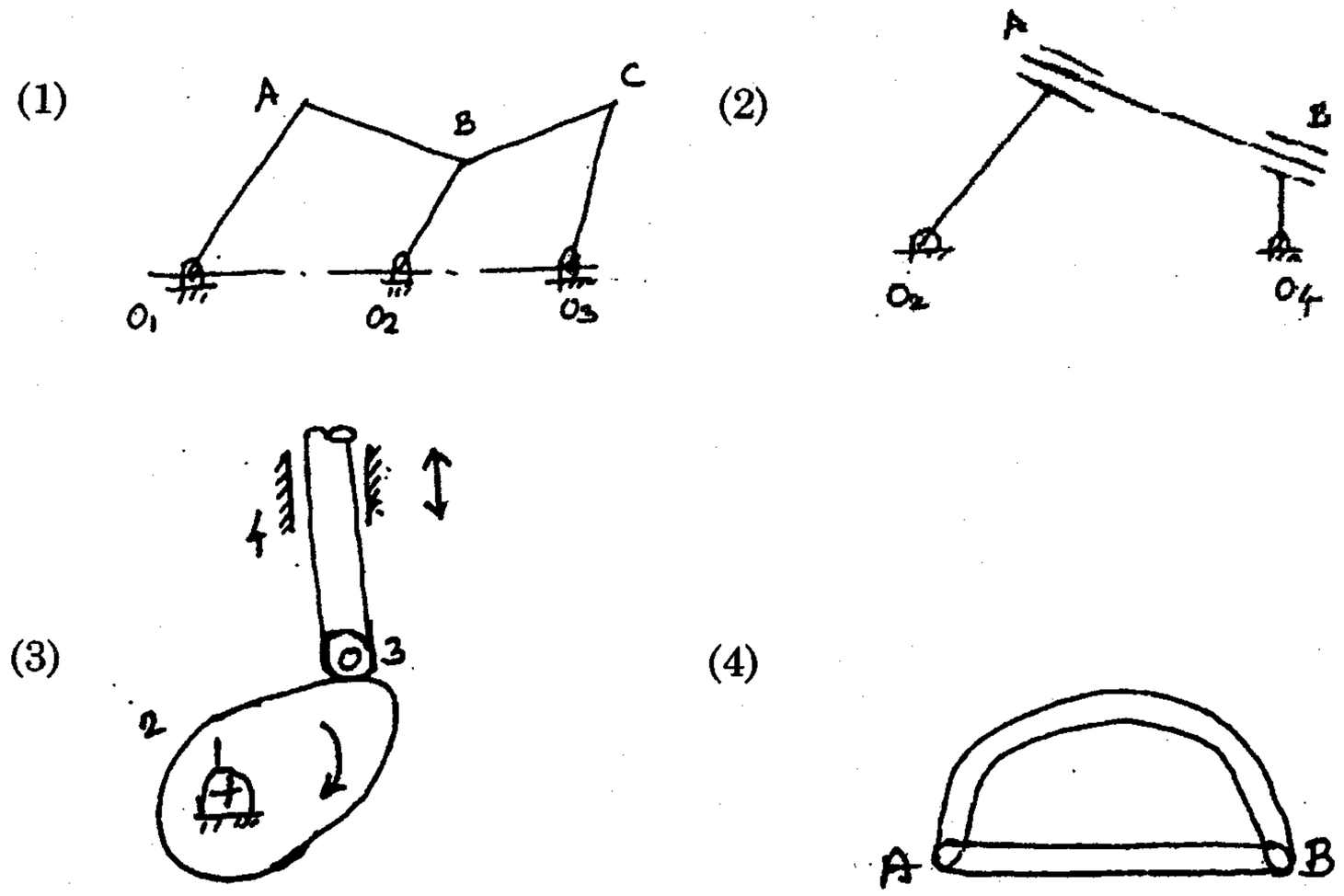

Fig. Q.11(a) (ii)

Or

(b) (i) Sketch the following straight line generators and show the path traced by the point.

(1) Peaucillier mechanism.

(2) Pantograph linkage. (8)

(ii) Explain with sketches any two inversions of a double slider crank mechanism. (8)

12. (a) For the mechanism shown in Fig. Q.12 (a), determine the velocities of points C and A and angular velocities of links 3 and 4. The link 2 rotates at 150 rpm. O_2A = 380 mm, O_4B = 250 mm, AC = 250 mm, BC = 400 mm and O_2O_4 = 750 mm.

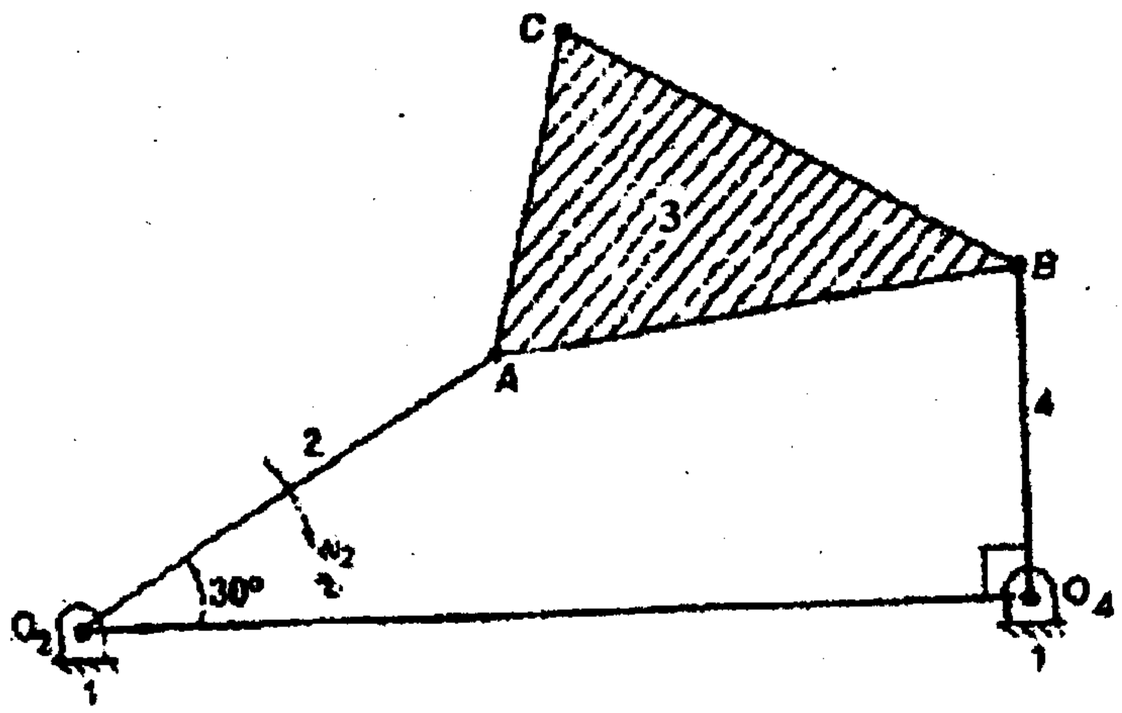

Fig. Q.12 (a)

Or

(b) For the slider-crank mechanism shown in Fig.Q.12(b), determine (i) the acceleration of slider B and (ii) acceleration of point C. The crank OA rotates at 180 rpm. Constant OA = 500 mm, AB = 1500 mm and AC = 250 mm.

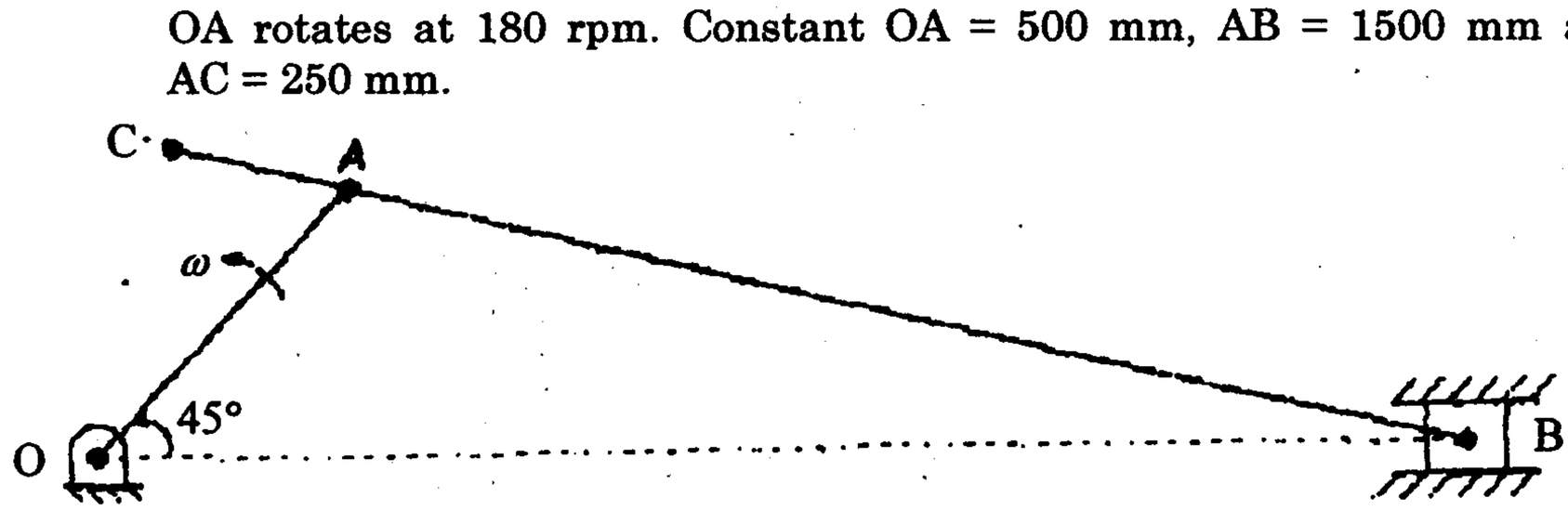

Fig.Q.12(b)

13. (a) A cam with a minimum radius of 25 mm is to be designed for a knife-edge follower with the following data:

- To raise the follower through 35 mm during 60° rotation of the cam.
- Dwell for next 40° of the cam rotation.

Descending of the follower during the next 90° of the cam rotation.

Draw the profile of the cam if the ascending and descending of the cam is with simple harmonic motion and the line of stroke of the follower is offset 10 mm from the axis of the cam shaft. Determine the maximum velocity and acceleration of the follower during the ascent and the descent if the cam rotates at 150 rpm.

Or

(b) The following data relate to a symmetrical circular cam operating a flat-faced follower :

Minimum radius of the cam	=	40 mm
Lift	=	24 mm
Angle if lift	=	75°
Nose radius	=	8 mm
Speed of cam	=	420 rpm

Determine the main dimensions of the cam and the acceleration of the follower at the (i) beginning of the lift (ii) end of contact with the circular flank (iii) beginning of contact with the nose (iv) apex of nose.

14. (a) A pinion of 20 teeth and module 4 mm having involute profile drives a rack. The addendum of both pinion and rack is 6 mm.

(i) What is the least pressure angle which can be used to avoid undercutting? (4)

(ii) Derive the formula used for finding the pressure angle. (6)

(iii) Find the length of arc of contact. (3)

(iv) Find the number of pairs of teeth in contact at a time. (3)

Or

(b) In an epicyclic gear of the "Sun and Planet" type, the pitch circle diameter of the internally toothed ring gear is to be around 220 mm as nearly as possible. The module is 4 mm. When the ring gear is stationary, the arm which carries three planet wheels of equal size is to make one revolution for every five of the driving spindle carrying the sun gear.

(i) Determine suitable numbers of teeth for all gears. (9)

(ii) Find the exact diameter of pitch circle of the ring gear. (2)

(iii) If a torque of 20 N.m. is applied to the spindle carrying the sun gear, what torque will be required to keep the ring gear stationary? (5)

15. (a) (i) Derive an expression for the torque transmitted by a clutch, stating clearly the assumptions made. (8)

(ii) A clutch is required to transmit 10 kW at 3000 rpm. It is of single plate type, both sides being effective. The coefficient of friction is and the axial pressure is limited to 8.5 N/cm^2. Determine the dimensions of the plate, assuming that the external diameter is 1.4 times the inner diameter. (8)

Or

(b) (i) Derive an expression for the centrifugal tension in rope drives. (8)

(ii) A rope pulley with 10 ropes and peripheral speed of 1500 m/min transmits 100 kW. The angle embraced by each rope is 180°, the angle of groove is 40° and the coefficient of friction is 0.2. Find the tensions on the tight and slack sides of the rope, allowing for centrifugal tension. The weight of each rope is 6 N per metre run. (8)