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Question Paper Code : 77212

B.E/B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fourth Semester

Mechanical Engineering

ME6401-KINEMATICS OF MACHINERY

(Common to Mechanical, Automobile Engineering and Automation Engineering)

(Regulation 2013)

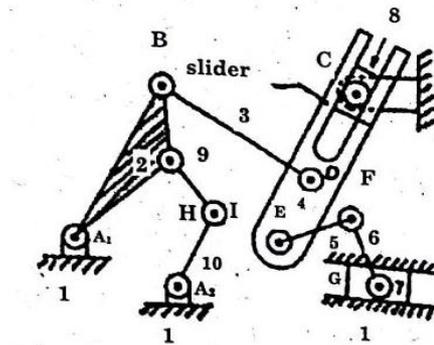
Time: Three hours

Maximum: 100 marks

Answer ALL questions.

PART – A (10 x 2= 20 marks)

1. Determine the number of freedom of the mechanism shown in the figure below:



2. Write a short note on complete and incomplete constraints in lower and higher pairs, depict your answer with neat sketches.
3. Write the relation between the number of instantaneous centres and the number of links in a mechanism.
4. Depict all the directions of Coriolis component of acceleration that arise in a completed cycle of quick return motion of the crank mechanism
5. Draw the displacement, velocity and acceleration diagrams for a follower when it moves with simple harmonic motion.
6. Why a roller follower is preferred to that of a knife edged follower?
7. What do you understand by the term 'interference' as applied to gears?
8. What are the Special advantages of epicyclic gear trams?
9. What is centrifugal tension in a belt? How does it affect the power transmitted?
10. Distinguish between brakes and dynamometers.

PART – B (5 × 16 = 80 Marks)

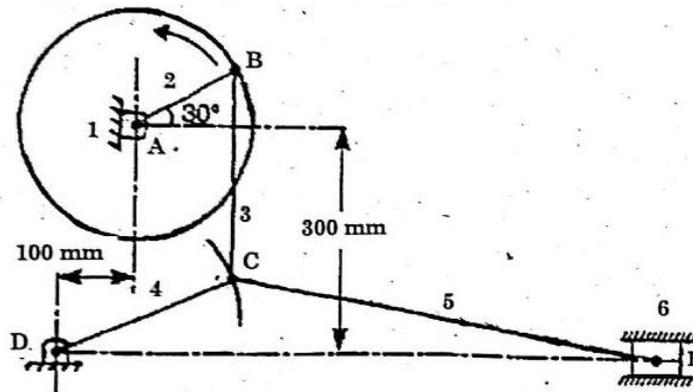
11 a What do you understand by inversion of a kinematic chain? Describe the mechanisms obtained by inversion of the four-bar chain

OR

b Sketch and describe the working of two different types of quick return mechanisms. Give examples of their applications. Derive an expression for the ratio of times taken in forward and return stroke for one of these mechanisms.

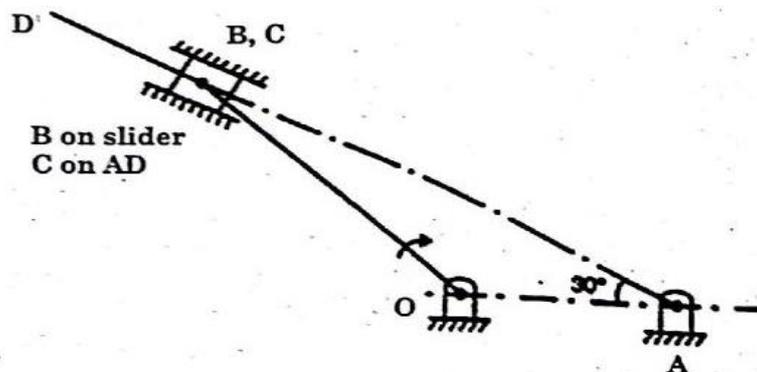
12 a Locate all the instantaneous centres of the mechanism as shown in Fig. shown below. The lengths of various links are: AB = 150 mm; BC = 300 mm; CD = 225 mm; and CE = 500 mm. When the crank AB rotates in the anticlockwise direction at uniform speed of 240 r.p.m.

Find (i) Velocity of the slider E, and (ii) Angular velocity of the links BC and CE.



OR

b A single cylinder rotary engine is shown below. OA is the fixed link, 200 mm long. OB is the connecting rod and is 520 mm long. The line of stroke is along AD and at the instant is inclined at 30° to the vertical. The body of the engine consisting of cylinders rotates at a uniform speed of 400 rpm about fixed centre A. Determine the acceleration of slider B and angular acceleration of connecting rod.



- 13 a The following particulars relate to a symmetrical circular cam operating a flat faced follower:

Least radius 16 mm, nose radius 3.2 mm, distance between cam shaft centre and nose centre 25 mm, angle of action of cam 150° and cam shaft speed: 600 r.p.m.

Assuming that there is no dwell between ascent or descent, determine the lift of the valve, the flank radius and the acceleration and retardation of the follower at a point where circular nose merges into Circular flank.

OR

- b A cam with 30 mm as minimum diameter is rotating clockwise at a uniform speed of 1200 r.p.m. and has to give the following motion to a roller follower 10 mm in diameter:

(i) Follower to complete outward stroke of 25 mm during 120° of cam rotation with equal uniform acceleration and retardation; (ii) Follower to dwell for 60° of cam rotation; (iii) Follower to return to its initial position during 90° of cam rotation with equal uniform acceleration and retardation; (iv) Follower to dwell for the remaining 90° of cam rotation. Draw the cam profile if the axis of the roller follower passes through the axis of the cam. Determine the maximum velocity of the follower during the outstroke and return stroke and also the uniform acceleration of the follower on the out stroke and the return stroke.

- 14 a Calculate: (i) Length of path of contact (ii) Arc of contact and (iii) The contact ratio when a pinion having 23 teeth drives a gear having teeth 57. The profile of the gears is involute with pressure angle 20° , module 8mm and addendum equal to one module.

OR

- b In an epicyclic gear train a gear C is keyed to the driving shaft A which rotates at 900 rpm. Gears D and E are fixed together and rotate freely on a pin carried by the arm M which is keyed to the driven shaft B. Gear D is in mesh with gear C while the gear E is in mesh with a fixed annular Wheel F. The annular wheel is concentric with the driven shaft B. If the shafts A and B are collinear and number of teeth on gears C, D, E and F are respectively 21, 28, 14 and 84. Determine the speed and sense of rotation of the driven shaft B.

- 15 a A flat belt, 8 mm thick and 100 mm wide transmits power between two pulleys,

running at 1600 m/min The mass of the belt is 0.9 kg/m length. The angle of lap in the smaller pulley is 165° and the coefficient of friction between the belt and pulley is 0.3. If the maximum permissible stress in the belt is 2 MN/m², Find: (i) Maximum power transmitted; and (ii) Initial tension in the belt.

OR

- b The spindle of a screw jack has single start square threads with an outside diameter of 45 mm and a pitch of 10 mm. The spindle moves in a fixed nut. The load 15 carried on a swivel head but 15 not free to rotate. The bearing surface of the swivel head has a mean diameter of 60 mm. The coefficient of friction between the nut and screw is 0.12 and that between the swivel head and the spindle is 0.10. Calculate the load which can be raised by efforts of 100 N each applied at the end of two levers each of effective length of 350 mm. Also determine the velocity ratio and the efficiency of the lifting arrangement