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Question Paper Code : 40829

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Third/Fourth Semester

Mechanical Engineering

ME 8492 — KINEMATICS OF MACHINERY

(Common to Mechanical Engineering (Sandwich)/Mechatronics Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is transmission angle and how it is related to mechanical advantage.
2. Name any four perfect straight line generating mechanisms.
3. State the application of velocity diagrams.
4. Why storm rotates counter clockwise in northern hemisphere?
5. List the effects of Cam sizing.
6. When undercutting occurs in cams? How it can be eliminated?
7. State the relationship between speed ratio and train value.
8. How the module of a gear influences its size and number of teeth?
9. Friction is a necessary evil-Justify.
10. Does friction depend on mass.

PART B — (5 × 13 = 65 marks)

11. (a) What do you mean by Grash off chain? Draw the inversions of a four bar mechanism and explain clearly how they are differing from each other. (13)

Or

(b) (i) Explain crank and slotted lever quick return motion mechanism with a neat diagram. (8)

(ii) A crank and slotted lever mechanism used in a shaper has a centre distance of 300 mm between the centre of oscillation of the slotted lever and the centre of rotation of the crank. The radius of the crank is 120 mm. Find the ratio of the time of cutting to the time of return stroke. (5)

12. (a) A mechanism, as shown in fig. 12 (a) has the following dimensions: OA = 200 mm; AB = 1.5 m; BC = 600 mm; CD = 500mm and BE = 400 mm. Locate all the instantaneous centres. If crank OA rotates uniformly at 120 r.p.m. clockwise, find 1. the velocity of B, C and D, 2. the angular velocity of the links AB, BC and CD.

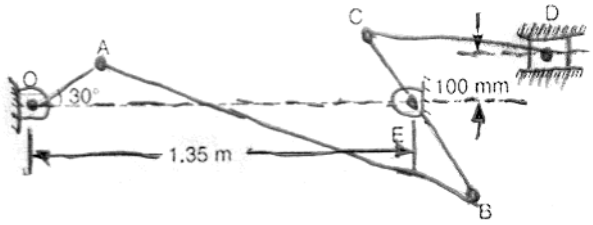

Figure – 12 (a)

Or

(b) A four bar mechanism in flg.12 (b) has the following dimensions: DA 300mm CB AB = 360 mm; DC = 600 mm. The link DC is fixed and the angle ADC is 60°. The driving link DA rotates uniformly at a speed of IOU r.p.m. clockwise and the constant driving torque has the magnitude of 50 N-m. Determine the velocity of the point B and angular velocity of the driven link CD. Also find the actual mechanical advantage and the resisting torque if the efficiency of the mechanism is 70 per cent.

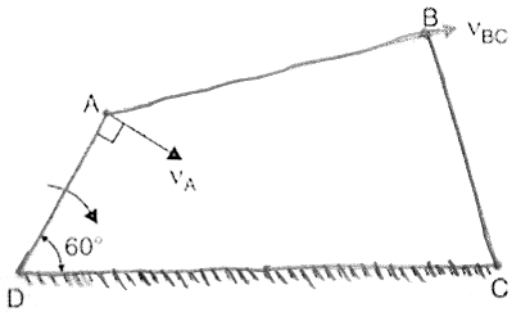

Figure – 12 (b)

13. (a) A cam drives a flat reciprocating follower in the following manner: During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam.

Or

(b) A symmetrical cam with convex flanks operates a flat-footed follower. The lift is 8mm, base circle radius 25mm and the nose radius 12 mm. The total angle of the cam action is 120°. 1. Find the radius of convex flanks, 2. Draw the profile of the cam, and 3. Determine the maximum velocity and the maximum acceleration when the cam shaft rotates at 500 r.p.m.

14. (a) A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact.

Or

(b) An epicyclic gear consists of three gears A, B and C as shown in Fig. 14 (b). The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 r.p.m. If the gear A is fixed, determine the speed of gears B and C.

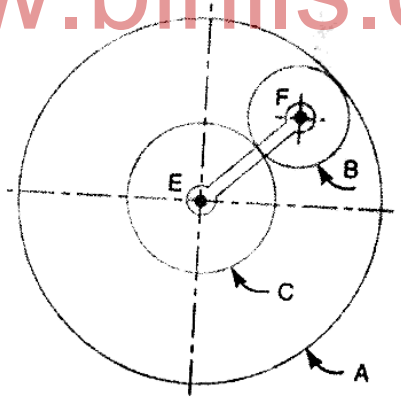

Figure – 14 (b)

15. (a) A dry single plate clutch is to be designed for an automotive vehicle whose engine is rated to give 100 kW at 2400 r.p.m. and maximum torque 500 N-m. The outer radius of friction plate is 25% more than the inner radius. The intensity of pressure between the plate is not to exceed 0.07 N/mm^2 . The coefficient of friction may be assumed equal to 0.3. The helical springs required by this clutch to provide axial force necessary to engage the clutch are eight, If each spring has stiffness equal to 40 N/mm, determine the initial compression in the springs and dimensions of the friction plate.

Or

(b) An Open belt drive connects two pulleys 1.2 m and 0.5 m diameter on parallel shafts 4 meters apart. The mass of the belt is 0.9 kg per meter length and the maximum tension is not to exceed 2000 N. The coefficient of friction is 0.3 The 1.2 in pulley, which is the driver, runs at 200 r.p.m. Due to belt slip on one of the pulleys, the velocity of the driven shaft is only 450 r.p.m. Calculate the torque on each of the two shafts, the Power transmitted, and Power lost in friction. What is the efficiency of the drive?

PART C — ($1 \times 15 = 15$ marks)

16. (a) In the mechanism shown in Fig 16 (a), determine the acceleration of the slider C. $O_1 A = 100$ mm. $AB = 105$ mm, $O_2 B = 150$ mm and BC = 300 mm. Crank O_1 A rotates at 180 rpm.

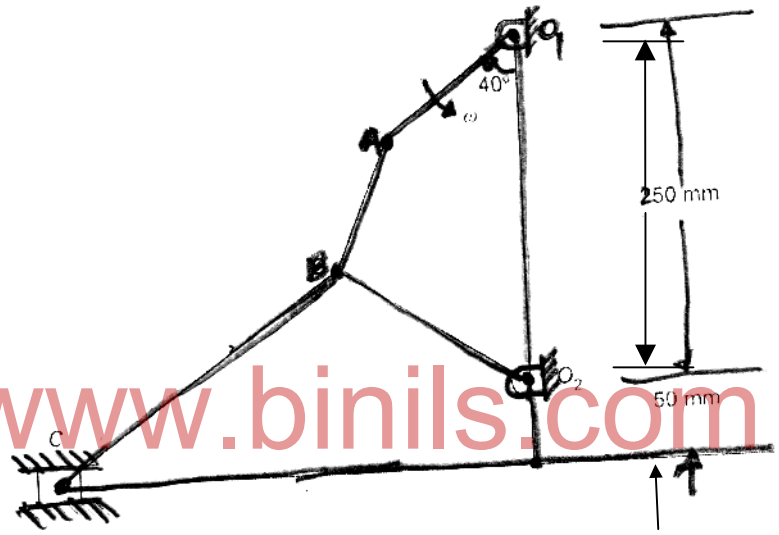

Figure – 16 (a)

Or

(b) Determine the degree of freedom of the mechanisms shown in Fig. 16 (b).

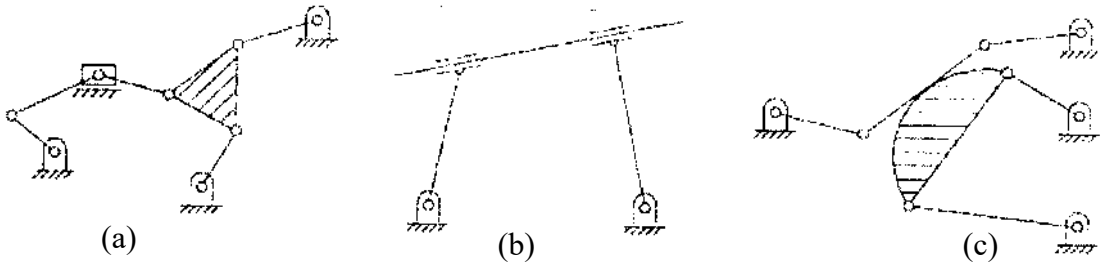

Figure – 16 (b)