(3 hours) Total Marks: 80

N.B. 1. Question No.1 is compulsory.

2. Answer any three questions from remaining questions.

3. Assume suitable data if required.

4. Figure to the right indicates full marks.

5. Use of standard design data book is permitted.

Q.1 Answer **any four** of the following. 20

a. What is a machine? Giving example, differentiate between a machine and a structure.

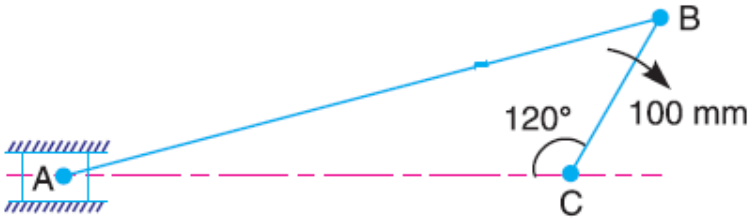
b. Explain the basic failure in keys.

c. State and prove Kennedy's theorem.

d. Explain any one straight line generation mechanism.

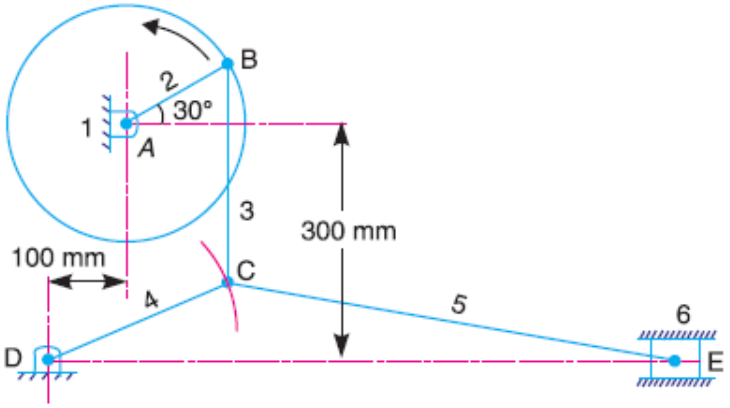
e. Explain the different types of follower.

Q.2 a. An engine mechanism is shown in Fig. The crank CB = 100 mm and the connecting rod BA = 300 mm. The crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s^2. Find: **1.** Velocity of slider A and angular velocity of AB, and **2.** acceleration of B and angular acceleration of AB. 12



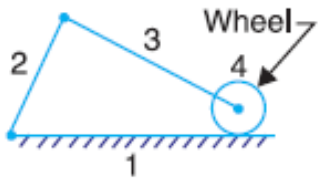
b. Explain any four mechanical properties of material. 8

Q.3 a. Locate all the instantaneous centres of the mechanism as shown in Fig. 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 a uniform speed of 240 r.p.m.; find 1. Velocity of the slider *E*, and 2. Angular velocity of the links *BC* and *CE*. 12



b. Explain the basic design procedure with any example. 8

Q.4 a. Define degree of freedom and find the degree of freedom for the configuration shown in fig. 06



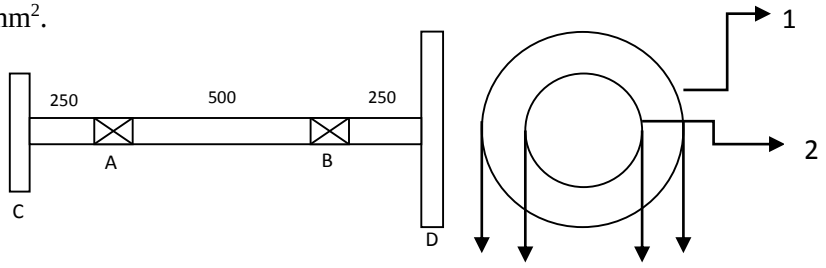
b. A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below : 14

1. To move outwards through 40 mm during 100° rotation of the cam ;
2. To dwell for next 80° ;
3. To return to its starting position during next 90°, and
4. To dwell for the rest period of a revolution i.e. 90°.

Draw the profile of the cam **when** the line of stroke of the follower passes through the centre of the cam shaft.

The displacement of the follower is to take place with uniform acceleration and uniform retardation. Determine the maximum velocity and acceleration of the follower when the cam shaft rotates at 900 r.p.m. Draw the displacement, velocity and acceleration diagrams for one complete revolution of the cam.

Q.5 a. The layout of shaft carrying two pulleys 1 & 2, supported on two bearing A and B is shown in fig. The shaft transmits 7.5 KW power at 360 RPM from pulley 1 to pulley 2. The diameters of pulley 1 & 2 are 250 and 500 mm respectively. The masses of pulley 1 and 2 are 10 kg and 30 kg respectively. The belt tension act vertically downward and ratio of belt tension on tight side to slack side for each pulley is 2.5:1. The shaft is made of plane carbon steel 40 C8 (s_{yt} = 380 n/mm^2) and the factor of safety is 3. Estimate suitable diameter of shaft. If the permissible angle of twist is 0.5^0 per meter length, calculate the shaft diameter on the basis of torsional rigidity. Assume G = 79300 N/mm^2. 12



b. Explain in detail design procedure for cotter joint. 08

Q.6 a. Design a rigid flanged coupling to transmit a power of 10 KW at 960 rpm. 15

b. Explain the theories of failure. 5

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