Q.P. Code :16736

(Time : 3 Hours)   [Total Marks: 80]

Please check whether you have got the right question paper

Note:

1. Question no.1 is compulsory.
2. Attempt any three questions from the remaining questions.
3. Assume suitable data wherever required.

1   Answer any four questions.   20
   (a)   State and explain Kennedy's theorem.
   (b)   Explain inversions of slider crank mechanism.
   (c)   Differentiate between longitudinal, transverse and torsional vibrations
   (d)   Explain the terms mechanism, machine, kinematic chain, degree of freedom and prismatic pair.
   (e)   Derive an expression to find minimum number of teeth on gear inorder to avoid interference.
   (f)   Explain any absorption type of dynamometer.
   (g)   Write a short note gyroscope.

2 (a)   In a mechanism as shown in the following Fig.1, the crank OA is 100 mm long and   15
         rotates in a clockwise direction at a speed of 100 rpm. The straight rod BCD rocks on a
         fixed point at C. The links BC and CD are each 200 mm long and the link AB is 300 mm
         long. The slider E, which is driven by the rod DE is 250 mm long. Find the velocity and
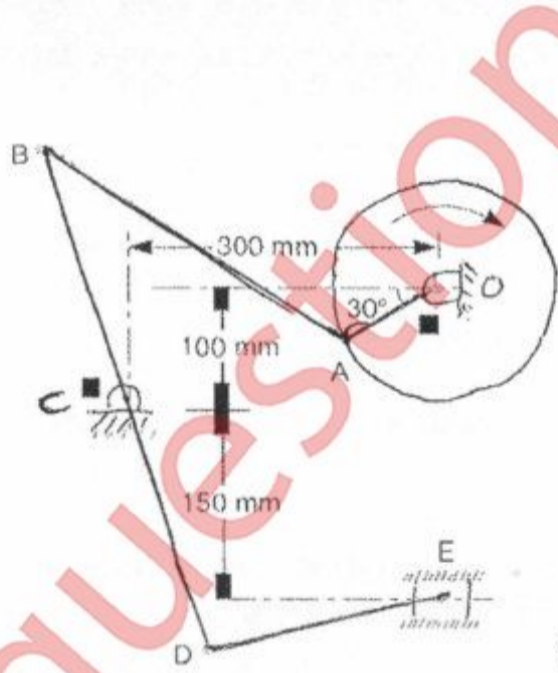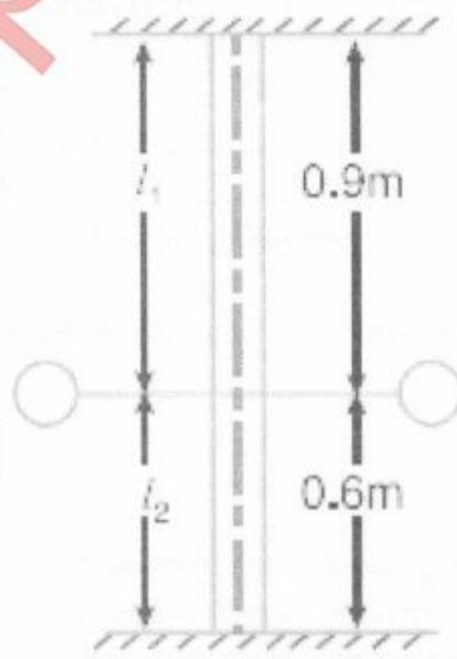   acceleration of E.

fig1

fig2

   (b)   Explain pantograph.   5

3 (a) A flywheel is mounted on a vertical shaft as shown in Fig.2. The both ends of the shaft **5** are fixed and its diameter is 50 mm. The flywheel has a mass of 500 kg. Find the natural frequencies of longitudinal and transverse vibrations. Take E = 200 GN/m2.

(b) A flat faced reciprocating follower has the following motion : **15**
      (i) The follower moves out for 80° of cam rotation with uniform acceleration and retardation, the acceleration being twice the retardation.
      (ii) The follower dwells for the next 80° of cam rotation.
      (iii) It moves in for the next 120° of cam rotation with uniform acceleration and retardation, the retardation being twice the acceleration.
      (iv) The follower dwells for the remaining period.
The base circle diameter of the cam is 60 mm and the stroke of the follower is 20 mm. The line of movement of the follower passes through the cam centre. Draw the displacement diagram and the profile of the cam very neatly showing all constructional details.

4 (a) Two gear wheels mesh externally and are to give a velocity ratio of 3. The teeth are of **10** involute form of module 6. The standard addendum is 1 module. If the pressure angle is 18° and pinion rotates at 90 r.p.m., find: 1. the number of teeth on each wheel, so that the interference is just avoided, 2. the length of the path of contact, and 3. the maximum velocity of sliding between the teeth.

(b) A single dry plate clutch transmits 7.5 kW at 900 r.p.m. The axial pressure is limited to **10** 0.07 N/mm2. If the coefficient of friction is 0.25, find 1. Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4, and 2. Outer and inner radii of the clutch plate.

5 (a) The following data refer to two cylinder locomotive with cranks at 90° : **10**
Reciprocating mass per cylinder = 300 kg ; Crank radius = 0.3 m ; Driving wheel diameter = 1.8 m ; Distance between cylinder centre lines = 0.65 m ; Distance between the driving wheel central planes = 1.55 m. Determine :
    i. The fraction of the reciprocating masses to be balanced, if the hammer blow is not to exceed 46 kN at 96.5 km/h.
    ii. The variation in tractive effort and
    iii. The maximum swaying couple.

(b) An epicyclic gear consists of three gears A, B and C as shown in the following fig 3. The **10** 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.

fig3
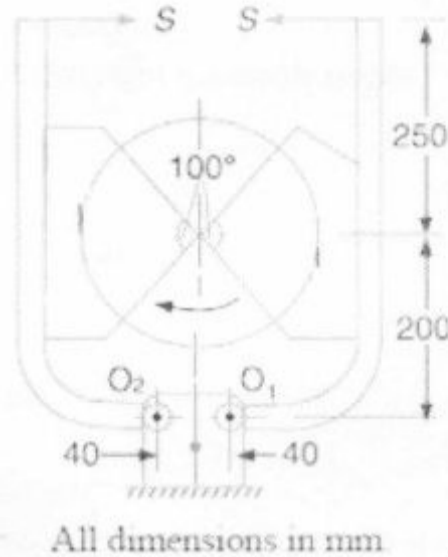
All dimensions in mm

fig4

6 (a) A double shoe brake, as shown in Fig. 4, is capable of absorbing a torque of 1400 N-m. **10** The diameter of the brake drum is 350 mm and the angle of contact for each shoe is 100°. If the coefficient of friction between the brake drum and lining is 0.4 ; find 1. the spring force necessary to set the brake ; and 2. The width of the brake shoes, if the bearing pressure on the lining material is not to exceed 0.3 N/mm^2.

(b) A steel shaft 1.5 m long is 95 mm in diameter for the first 0.6 m of its length, **10** 60 mm in diameter for the next 0.5 m of the length and 50 mm in diameter for the remaining 0.4 m of its length. The shaft carries two flywheels at two ends, the first having a mass of 900 kg and 0.85 m radius of gyration located at the 95 mm diameter end and the second having a mass of 700 kg and 0.55 m radius of gyration located at the other end. Determine the location of the node and the natural frequency of free torsional vibration of the system. The modulus of rigidity of shaft material may be taken as 80GN/m^2.

A6770F26CF24EE77E6B958C4E1FFDBF5