Paper Code: ME 502	Roll No.									

B.Tech

(SEM. V) ODD SEMESTER EXAMINATION, 2015-16

THEORY OF MACHINES-I

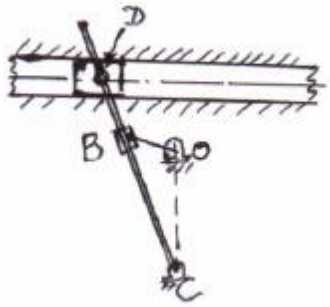
TIME: 3 HOURS **MAX.MARKS: 100**

NOTE: Attempt all questions, All question carry equal marks.

Q.1 Attempt any TWO parts of the following: 10x2=20

(a) A quick return mechanism s shown below, What should be the length of crank OB and the distance OC if the working stroke of the mechanism is 15cm and the time ratio of working to return stroke is 2:1?

(Hint: Length OB and OC cannot be independent of each other. Hence assume one)

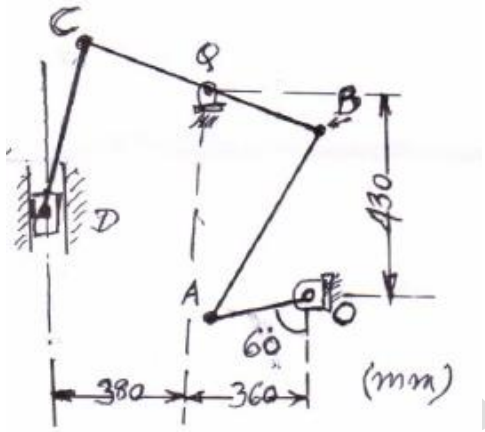


b) State GRASHOF Law. Sketch DRAG-LINK (double crank) insertion of four-bar chain.

(c) The distance between the axis of two shafts connected by Oldham's coupling is 1cm. Determine the kinetic energy in the intermediate piece when the shafts rotate at 300 r.p.m. The mass of the intermediate disc is 4 kg and its radius of gyration abut C.G. located at the geometric centre of the disc is 15cm.

Q.2 Attempt any TWO parts of the following: 10x2=20

(a) A Six link mechanism is shown below. The dimensions of the links are OA=220mm, AB=485mm, BO=310mm, BC=590mm and CD=400mm. Find the velocity and acceleration of slider D when crank OA rotates clockwise at a uniform speed of 150 r.p.m.



b) The driving shaft of a Hooke's joint rotates at a uniform speed of 400 r.p.m. If the maximum variation in the speed of driven shaft is $\pm$5% of the mean speed, determine the greatest permissible angle between the axes of shafts.

Why is it necessary to keep the angle between the axis of the driving and driven shafts to the minimum possible? What is the harm if this angle is large especially when the masses attached to driven shaft are considerable?

(c) Sketch at least four different PANTOGRAPH mechanisms. Which of these mechanisms forms the basis of the Engraving machine installed in our machine shop? Explain how the "ratio" can be altered in our engraving machine.

Q.3 Attempt any TWO parts of the following: 10x2=20

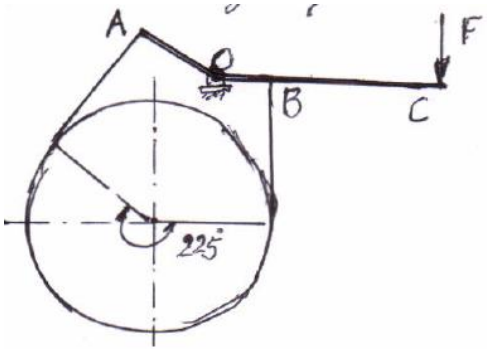
(a) A multi-plate clutch transmits 55 kW of power at 1800 r.p.m. Coefficient of friction for friction surfaces is 0%. Axial intensity of pressure is not to exceed 160KN/m^2. The internal radius is 80 mm and is 0.7 times the external radius. Find the number of friction surfaces required.

Explain why even in the best of clutches, slipping cannot be avoided at the time the clutch is being engaged.

(b) An open belt drive transmits 8 KW power from a shaft rotating at 240 r.p.m to another shaft rotating at 160 r.p.m. The belt is 8 mm thick. The diameter of the smaller pulley is 600 mm and the two shaft are 5 meters apart μ=0.25. If maximum stress in the belt is limited to 3 N/mm^2, find the worth of the left.

(c) A differential band brake has an angle of contact of 225^{0}as shown below:

The lengths OA= 150mm, OB=35 mm & OC = 500 mm, Diameter of Brake drum is 350mm

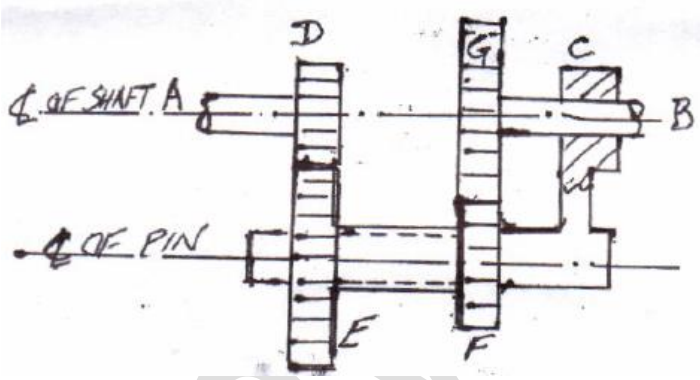


The brake is to sustain a torque of 350 N.m and the coefficient of friction is between the band and drum is 0.30. Determine the value of required force F for clockwise as well as anti-clockwise rotation of the drum.

Q.4 Attempt any TWO parts of the following: 10x2=20

(a) Two 20^0 pressure angle involute gears in mesh have a module of 10mm. Addendum is equal to one module Large gear has 50 teeth and the pinion has 13 teeth. Does interference occur? If it occurs, to what value should the pressure angle be changed to eliminate interference?

(b) In the epicyclic gear train shown, the gear G is held stationary by shaft B and the arm 'C' rotates at 200 r.p.m. The gears F (with 20 teeth) and E(with 40 teeth) are compounded and rotate freely on the join carried by the arm C. Gear D is rigidly mounted on shaft A and has 20 teeth. Find speed of shaft A and to relative direction to shaft B.



(c) Draw , to scale, the base circle (diameter 15cm) of a pinion of module 10 and pressure angle of 20^0 On this base circle, choose any point 'A' and draw, to scale, the full involute profile of a tooth, assuming the addendum to be equal to one module. The details of geometrical construction and calculations should be preserved and not rubbed out.

Q.5 Attempt only One part of the following: 20x1=20

(A) In a tangent cam operating a roller follower, base circle radius is 15mm and roller radius is 10mm. Angle of ascent is 75^0 and total lift is 17.5 mm. If the speed of cam is 600 r.p.m. Calculate the principal dimensions of cam and the acceleration of follower at the beginning of lift.

(B) Find expressions for velocity and acceleration of a FLAT faced follower with circular arc-cam both for contact at nose as well as flank of the CAM.