S.E. (Mechanical) (Sem-IV) (CB)

Paper / Subject Code: 41205 / Kinematics of Machinery Date- 17/12/19

03 Hrs **[Total Marks 80]**

N.B.:
(1) **Question No.1 is compulsory**
(2) Attempt any **three** questions out of remaining **five** questions
(3) Figures to right indicate full marks
(4) Assume suitable data if **necessary**.
(5) Notations carry usual meaning.

Q.1 **Attempt any four** 20

A. What is Kutzback's criterion for degrees of freedom of plane mechanism? In what way is Gruebler's criterion different from it?.

B. Differentiate between lower pair and higher pair.

C. Define with respect to cam i) Base circle ii) pitch circle iii) trace point iv) pressure angle.

D. What is crowning of pulley in flat drives? What is its use.

E. Explain the self locking and self energizing in brakes.

Q.2A. The mechanism, as shown in Fig.1, has the dimensions of various links as follows : AB = DE = 150 mm ; BC = CD = 450 mm ; EF = 375 mm. The crank AB makes an angle of 45° with the horizontal and rotates about A in the clockwise direction at a uniform speed of 120 r.p.m. The lever DC oscillates about the fixed point D, which is connected to AB by the coupler BC. The block F moves in the horizontal guides, being driven by the link EF. Determine velocity of the block F and angular velocity of DC 14
1. By instantaneous centre method
2. By relative velocity method

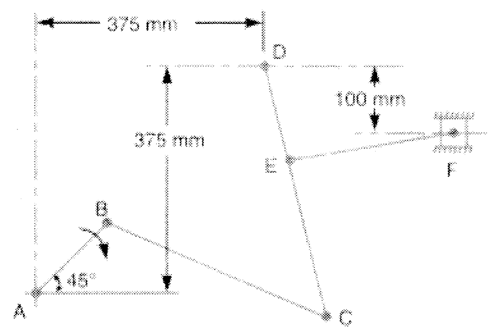

Figure 1

B. State and prove law of gearing. 06

Q.3A. 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. 10

B. An open belt drive is required to transmit 10KW of power from a motor running at 600rpm. Diameter of the driving pulley is 250mm. The speed of the driven pulley is 220rpm. The belt is 12mm thick and has a mass density of $0.001 g/mm^3$. Safe stress in the belt is not to exceed $2.5N/mm^2$. The two shafts are 1.25 m apart. The coefficient of friction is 0.25. Determine the width of the belt. 10

Q.4 A. The mechanism as shown in fig. 2 of a radial valve gear. The crank OA turns uniformly at 150 r.p.m and is pinned at A to rod AB. The point C in the rod is guided in the circular path with D as centre and DC as radius. The dimensions of various links are: OA = 150 mm ; AB = 550 mm ; AC = 450 mm ; DC = 500 mm ; BE = 350 mm. 14
Determine velocity and acceleration of the ram E for the given position of the mechanism.

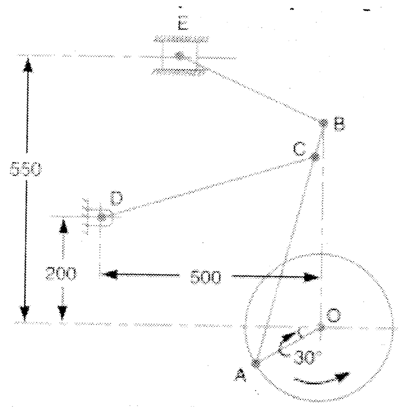

Figure 2

B. What is pantograph? Show that it can produce paths exactly similar to the ones traced out by a point on a link on an enlarged or reduced scale. 06

Q.5A. In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D - E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 r.p.m. clockwise 08

B. A sphere of radius 0.2m starts rolling without slip up an inclined at an angle of 30^0 with the horizontal. If the initial velocity of sphere 10rad/s. Determine how far sphere will travel before it reverse its motion. 06

C. Explain chordal action in chain drive. 06

Q.6A. Prove that the velocity of sliding in gears is proportional to the distance of the point of contact from the pitch point . 08

B. A cam is rotating at 800 rpm operate a reciprocating knife edge follower. The least radius of cam is 30mm , stroke of follower is 30mm. Ascent takes place by uniform accelereation and deceleration and descent by simple harmonic motion. Ascent take place by 120^0 and descent during 90^0 of cam rotation. Dwell between ascent and descent 30^0. Sketch displacement, velocity and acceleration. 12
