B.Tech Sem – IV (2007 Course) (Mechanical Engg.) : WINTER - 2017

SUBJECT: THEORY OF MACHINES-I

Day : **Wednesday** Time : **02.30 PM TO 06.30 PM**

Date : **22/11/2017** **W-2017-2427** Max. Marks : 80.

N.B.:

1) Q. No. 1 and Q. No. 5 are **COMPULSORY.** Out of the remaining attempt any **TWO** questions from each section.
2) Both the sections should be written in **SEPARATE** answer books.
3) Figures to the **RIGHT** indicate full marks.
4) Assume suitable data, if necessary.
5) Draw neat labeled diagrams **WHEREVER** necessary.

SECTION-I

Q.1 **a)** Identify the kinematic chains to which the following mechanisms belong : **(05)**

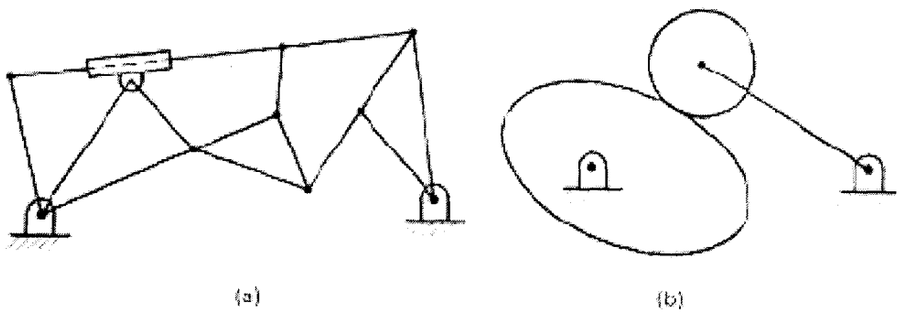
i. Steam engine mechanism ;
ii. Beam engine ;
iii. Whitworth quick return motion mechanism;
iv. Elliptical trammels.
v. Oldhamm's coupling

b) Sketch a pantograph, explain its working and show that it can be used to reproduce to an enlarged scale a given figure. **(05)**

c) Discuss various types of instantaneous centre with the help of example. **(04)**

Q.2 **a)** In a crank and slotted lever quick return motion mechanism, the distance between the fixed centres O and C is 200 mm. The driving crank CP is 75 mm long. The pin Q on the slotted lever, 360 mm from the fulcrum O, is connected by a link QR 100 mm long, to a pin R on the ram. The line of stroke of R is perpendicular to OC and intersects OC produced at a point 150 mm from C. Determine the ratio of times taken on the cutting and return strokes. **(06)**

b) Determine the degree of freedom of the mechanisms shown in Fig. **(07)**



(a) (b)

Fig 1

Q.3 **a)** Prove that Davis steering gear is capable to give correct steering action at all steering angles. **(06)**

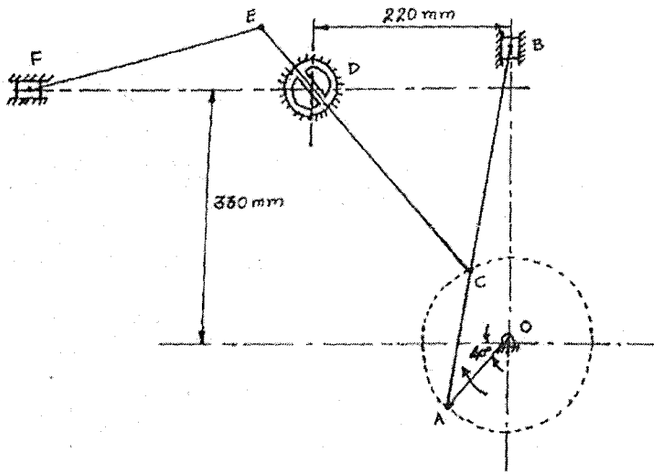
b) A single Hooke joint connects the shafts having shaft angle 15^0. Find the angle turned through by the driving shaft when the speed ratio is **(07)**

a)Maximum b) Minimum and c) One

Also find the angle turned through by the driving shaft when the driven shaft has maximum retardation.

P.T.O.

Q.4 Fig. shows a crank OA 110 mm long rotating clockwise about 'O' at 160 r.p.m., AB is connecting rod 440 mm long. A point 'C' on AB is 165 mm from A; the rod CE 385 mm long is attached. The rod CE slides in a slot in a trunion at D. The end E is connected by a link EF 330 mm long to the horizontally moving slides "F" for the mechanism shown in the figure. Determine the velocity of slider, F using instantaneous centre method. **(13)**



SECTION-II

Q.5 **a)** Derive the loop closure equation for slider crank mechanism. **(04)**

b) What do you mean by "correction couple"? When do we need to consider it? **(05)**

c) A function varies from 0 to 10. Find the Chebychev spacing for six precision points **(05)**

Q.6 For an I.C. engine mechanism the crank radius is 10 cm and connecting rod length is 50 cm. The crank is rotating in anticlockwise direction with an angular velocity of 20 r/s and angular acceleration of $125 r/s^2$. Find the acceleration of the piston and the angular acceleration of connecting rod when the crank is 50^0 from the inner dead centre using complex algebra method. **(13)**

Q.7 In IC engine mechanism, the crank length is 40 cm and connecting rod length is 95 cm. The diameter of piston is 10 cm and net gas pressure acting is 15 N/cm2. Find : **(13)**

i) Thrust on connecting rod.
ii) Piston side thrust.
iii) Torque acting on crankshaft.
iv) Radial load on main bearings when crank is at from TDC.

Q.8 Synthesize a four bar mechanism to generate the function y = log x, where x varies between 1 and 10. Use three accuracy points with Chebyshev's spacing. Assume $\theta_S = 45°$; $\theta_F = 105°$; $\phi_S = 135°$ and $\phi_F = 225°$. Take the length of the smallest link equal to 50 mm. **(13)**

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