B.TECH SEM – IV (2007 COURSE) (PRODUCTION ENGG.) :
SUMMER - 2018
SUBJECT: THEORY OF MACHINES

Day : **Thursday** Time : **10.00 AM TO 02.00 PM**
Date : **07/06/2018** Max. Marks: 80

S-2018-2636

N. B. :

1) **Q.No.1** and **Q. No.5** are **COMPULSORY.** Out of the remaining attempt **ANY TWO** questions in from each Section.
2) Figures to the right indicate **FULL** marks.
3) Answer the both the sections should be written in the **SEPARATE** answer books.
4) Assume suitable data, if necessary.

SECTION-I

Q.1 **a)** Explain with sketch any two inversions of a double slider crank chain. **(05)**

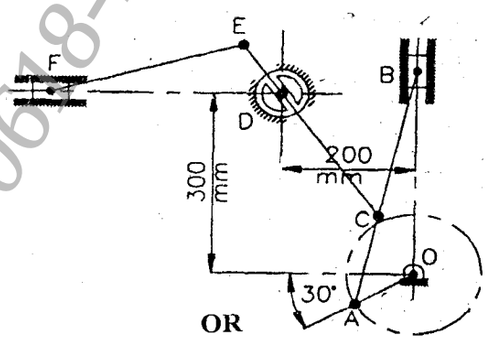
b) What is pantograph? Explain its working with sketch. **(05)**

c) Explain body centrode and space centrode with suitable sketch. **(04)**

Q.2 **a)** Define kinematic pair and discuss various types with examples. **(07)**

b) Two shafts are connected by a Hooke's joint. The driving shaft is rotating at a uniform speed of 1000 rpm. Find the greatest permissible angle between the axes of the two shafts so that the total fluctuation of speed does not exceed 90 rpm. **(06)**

Q.3 Following figure shows a crank OA, 100 mm long, rotating clockwise about '0' at 130 rpm. AB is connecting rod 400 mm long. At a point C on AB, 150 mm from A, the rod CE, 350 mm long is attached. This rod CE slides in a slot in a trunnion at D. The end E is connected by a link EF, 300 mm long, to the horizontally moving slider F. For the mechanism in the position shown, determine using theorem of three centres in line, the velocity of F. **(13)**



OR

Q.4 Link PQ is 200 mm long. End P moves long a vertical path with SHM the frequency of oscillations being 10 Hz. The travel of end P, between extreme positions, is 50 mm. The link slides through a block pivoted at R which is 75 mm below and 75 mm to the right of centre of line of stroke of P.
Determine the magnitude of velocity and acceleration of end Q at an instant when end P, while moving downwards is 12.5 mm below the upper limit of the travel. **(13)**

P.T.O.

SECTION-II

Q.5 **a)** Explain 'Balancing of Radial Engines'. **(05)**

b) Derive Freudenstein's Equation for displacement in synthesis of four bar mechanism. **(05)**

c) Explain classification of followers with neat sketches. **(04)**

Q.6 **a)** A marine engine has stroke of 200 mm and a connecting rod of length 400 mm. Its C.G. being 175 mm from the crank pin center and the radius of gyration about C.G. being 125 mm. The connecting rod has a mass of 120 kg and the reciprocating mass is 90 kg. The crank rotates at 240 rpm. Determine: **(08)**

i) The crank shaft torque due to inertia of the reciprocating parts.
ii) The kinetic energy of the connecting rod for a crank angle of 45^0.

b) Prove that the resultant unbalanced force is minimum when half of the reciprocating masses are balanced by rotating masses, i.e when $C=\frac{1}{2}$. **(05)**

Q.7 Construct the cam profile to suit the following specifications. **(13)**

i) Cam shaft diameter = 40 mm
ii) Least radius of cam = 25 mm
iii) Diameter of roller = 25 mm
iv) Angle of lift = 120^0
v) Angle of fall = 150^0
vi) Lift of the follower = 40 mm

Numbers of pauses are two of equal interval between motions.
During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off set 12.5 mm from the centre of the cam.

Q.8 The three cranks of a three cylinder locomotive are all on the same axle and are set at 120^0. The pitch of the cylinder is 1m and stroke of each piston is 0.6m. The reciprocating masses are 300 kg for inside cylinder and 260 kg for each outside cylinder and the planes of rotation of the balance weights are 0.8 m from the insider crank. If 40% of the reciprocating parts are to be balanced, find the magnitude and position of the balancing masses required at a radius of 0.6m. The hammer blow per wheel when the axle makes 6 r.p.s. **(13)**

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