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B. TECH.
(SEM V) THEORY EXAMINATION 2020-21
KINEMATICS OF MACHINES

Time: 3 Hours

Total Marks: 100

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief. 2 x 10 = 20

a.	What are the different types of constrained motion?
b.	State the Grashoff's Law for a planer four bar mechanism.
c.	How is the sense and direction of Coriolis component of acceleration determined?
d.	What do you mean by straight line motion mechanism?
e.	What are the methods for reducing pressure angle of a cam?
f.	How the cam size is defined?
g.	What do you understand by the term 'epicycloids' and 'hypocycloid'?
h.	What do you mean by Interference and Undercutting in involute gears?
i.	What do you mean by creep of belt?
j.	What is the effect of centrifugal tension on power transmission?

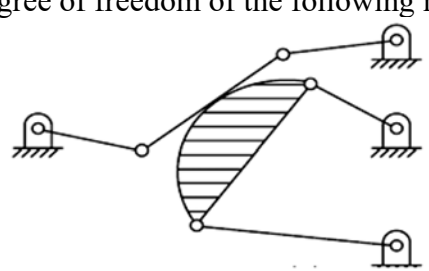
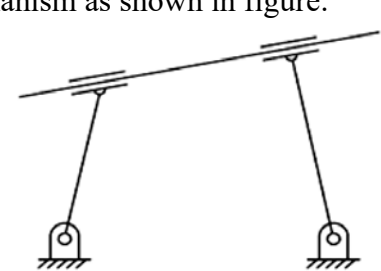
SECTION B

2. Attempt any three of the following: 10 x 3 = 30

a.	What do you mean by inversion of mechanism? What are the inversions of single slider crank chain and also explain the working of 3 rd inversion of single slider crank chain with kinematic link diagram?
b.	What is Hooke's joint? with a neat sketch, describe the working of a Hooke's joint. Also show that for a Hooke's joint, $\tan \theta = \cos \alpha \tan \phi$ where α = angle of inclination of the driven shaft with driving shaft, and ϕ and θ are the angles turned by driven and driving shafts at any instant.
c.	Define the following term with respect to Cam: Base circle, Pressure angle, Pitch circle, Stroke of follower and Prime circle.
d.	Define Gear and Gear train. How gears are classified? Explain with suitable example with neat sketches.
e.	A simple band brake is applied to a rotating drum of diameter 500 mm. The angle of lap of the band on the drum is 270°. One end of the band is attached to a fulcrum pin of the lever and other end is to a pin 100 from the fulcrum. If the co-efficient of friction is 0.25 and a braking force of 90 N is applied at a distance of 600 mm from the fulcrum, find the braking torque when the drum rotate in the (i) anticlockwise direction, and (ii) clockwise direction.

SECTION C

3. Attempt any one part of the following: 10 x 1 = 10

a.	For a planer mechanism, derive an expression for Grubler's equation and calculate the degree of freedom of the following mechanism as shown in figure: <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>(i)</p> </div> <div style="text-align: center;">  <p>(ii)</p> </div> </div>
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b.	In a crank and slotted lever quick return motion mechanism, if length of driving crank is 400 mm, what should be the distance between fixed pivots if required time ratio of forward stroke to return stroke is 2:1.
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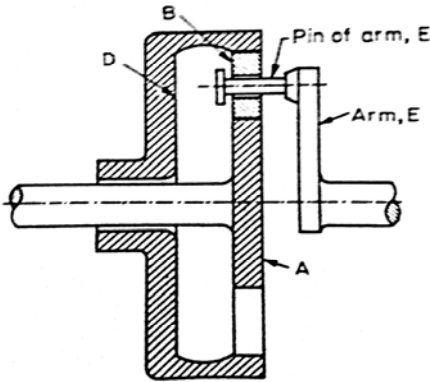
4. Attempt any one part of the following: 10 x 1 = 10

a.	Explain the Klein's construction for finding velocity and acceleration of piston in slider crank mechanism.
b.	The crank of a slider crank mechanism is 100 mm and the connecting rod is 300 mm with center of gravity G, 100 mm from gudgeon pin. The crank makes a speed of 75 rad/s and an angular acceleration of 1200 rad/sec ² clockwise direction. When it has turned 120° from inner dead center position. Find: 1. velocity and acceleration of G and 2. angular velocity and angular acceleration of connecting rod.

5. Attempt any one part of the following: 10 x 1 = 10

a.	Deduce the expression for displacement, velocity and acceleration when the follower moves with uniform velocity and also draw the velocity and acceleration profile.
b.	It is required to set out the profile of a cam to give the following motion to the reciprocating follower with a flat faced contact face: (i) Follower to have a stroke of 20 mm during 120° of cam rotation; (ii) Follower to dwell for 30° of cam rotation; (iii) Follower to return to its initial position during 120° of cam rotation; and (iv) Follower to dwell for remaining 90° of cam rotation. The minimum radius of the cam is 25 mm. The out stroke of the follower is performed with uniform velocity and the return stroke with equal uniform acceleration and retardation. Determine maximum velocity and acceleration of the follower during outstroke and return stroke if cam shaft rotate at 300 rpm clockwise.

6. Attempt any one part of the following: 10 x 1 = 10

a.	The sun and planet gear of an epicyclic gear train are as shown in figure.1. The annular gear D has 100 internal teeth, the sun gear A has 50 external teeth and planet gear B has 25 external teeth. The Gear B meshes with gear D and gear A. The gear B is carried on the arm E, which rotates about the centre annular gear D. If the gear D is fixed and arm rotate at 20 rpm, then find the speed of gear A and B.	
b.	Two mating gears have 50 and 13 involute teeth of module 10 mm and 20° pressure angle. The addendum is one module. Does the interference occur? If it occurs, to what value should the pressure angle be changed to eliminate interference?	

7. Attempt any one part of the following: 10 x 1 = 10

a.	Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25?
b.	Differentiate between: (i) Self-locking brake and self-energized brake (ii) Simple band brake and differential band brake