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AU/ME-222 (CBCS)

B.E., III Semester

Examination, December 2017

Choice Based Credit System (CBCS)

Theory of Machines and Mechanisms

Time : Three Hours

Maximum Marks : 60

Note: i) There are eight questions.
ii) Attempt any five questions.
iii) All questions are carrying equal marks.

1. Followings are the statements write whether it is True or False.
   i) A kinematic chain is an assembly of links in which the relative motions of the link is possible and the motion of the each relative to the other is definite.
   ii) If three bodies have relative motion among themselves, their I-centers lie on the contact points of these bodies.
   iii) Acceleration is the derivative of velocity with respect to time and is proportional to the slope of the tangent to the velocity-time curve for any instant.
   iv) Complicated output motion which are otherwise difficult to achieve can easily be produced with the help of cam.
   v) The effect of the slip is to increase the speed of the belt on the driving shaft.
   vi) When an annular wheel is added to the epicyclic gear train, the combination is usually referred as sun and planet gear.

2. a) Explain with the help of neat sketch a quick return mechanism using four bar chain.
   b) Determine the maximum permissible angle between the shaft axes of a universal joint if the driving shaft rotates at 1000rpm and the total fluctuation of speed does not exceed to 75 rpm. Also, find the maximum and minimum speed of the driving shaft.

3. a) State and prove Kennedy's theorem as applicable to instantaneous centres of rotation of three bodies. How helpful in locating various instantaneous centers of a mechanism?
   b) A link AB of a four bar mechanism ABCD revolves uniformly at 120RPM in a clockwise direction. Find the angular acceleration of links BC, CD and point E (lie in the link BC). Given: AB=7.5cm, BC = 17.5cm, EC=5cm, CD=15cm, DA=10cm and $\angle BAD=90°$.

4. a) Derive a relation for minimum number of teeth on the gear wheel and pinion to avoid interference.
   b) What is a sun and planet gear? Give the procedure to analyses such gear train?

5. a) How are the cam classified? Explain the procedure to layout the cam profile for a reciprocating follower.
   b) Deduced expression for the velocity and acceleration of the follower when it moves with cycloidal motion.

6. a) How do the effects of gyroscopic couple and of centrifugal force make the rider of two-wheeler tilt on one side? Derive a relation for the limiting speed of the vehicle.

b) Determine the maximum power that can be transmitted through a flat belt drive having the cross-sectional area of the belt is 300mm × 12mm. Ratio of friction tensions is2.2. Maximum permissible tension in the belt is 2MPa. The density of belt material is 1100kg/m^3.

7. The following data relate to a cam profile in which the follower moves with uniform acceleration and deceleration during outstroke and return stroke.

Minimum radius of cam = 25mm	Roller diameter = 7.5mm
Offset of the follower axis = 12mm	Stroke = 28mm
Angle of outstroke = 60°	Angle of return stroke= 90°
Angle of dwell after outstroke = 45°	Speed of cam = 200 rpm

Draw the profile of the cam and determine the maximum velocity and the uniform acceleration of the follower during the outstroke and the return stroke.

8. A reciprocating engine mechanism has crank 10cm and connecting rod 30cm with the center of gravity G, 10cm from crank pin. In the position of 120° from the inner dead centre the crank has a velocity of 75rad/s and an angular acceleration of 1200 rad/s^2.

Find:

i) The velocity and acceleration of G

ii) The angular velocity and angular acceleration of connecting rod.

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