

**B.Tech. MECHANICAL ENGINEERING
(COMPUTER INTEGRATED
MANUFACTURING) / BTMEVI**

Term-End Examination

00952

June, 2019

BME-020 : KINEMATICS & DYNAMICS OF MECHANISMS

Time : 3 hours

Maximum Marks : 70

Note : Attempt any five questions. All questions carry equal marks. Use of scientific calculator is permitted. Missing data may be assumed suitably, if any. Standard symbols and notations have their usual meaning.

1. A four-bar chain is represented by a quadrilateral ABCD in which AD link is fixed and is 200 cm long. The crank AB 6.25 cm long rotates in a clockwise direction at 95.5 rpm and drives the link CD 11.25 cm long by means of the connecting link BC 17.5 cm long. Draw the velocity and acceleration diagrams when angle $BAD = 60^\circ$ and B and C lie on the same side of AD. Determine the angular velocity and angular acceleration of links BC and CD.

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2. A leather belt is required to transmit 9 kW from a pulley 120 cm in diameter running at 200 rpm. The angle embraced is 165° and the coefficient of friction between leather belt and pulley is 0.3. If the safe working stress for the leather belt is 140 N/cm^2 , the mass of leather is 1 gm/cm^3 and the thickness of the belt is 10 mm, determine the width of the belt taking the centrifugal tension into account.

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3. A pair of 20° full depth involute spur gears having 30 and 50 teeth respectively of module 4 mm are in mesh. The smaller gear rotates at 1000 rpm. Determine

(a) sliding velocities at engagement and disengagement of a pair of teeth, and

(b) contact ratio.

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4. A Hartnell governor having a central sleeve spring and two right-angled bell crank levers operates between 290 rpm and 310 rpm for a sleeve lift of 15 mm. The sleeve arms and ball arms are 80 mm and 120 mm respectively. The levers are pivoted at 120 mm from the governor axis and mass of each ball is 2.5 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine

(a) loads on the spring at the lowest and at the highest equilibrium speeds, and

(b) stiffness of the spring.

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5. Draw the profile of a cam, operating a knife-edge follower when the axis of the follower passes through the axis of cam shaft, from the following data :
- (a) Follower to move outwards through 40 mm during 60° of cam rotation.
 - (b) Follower to dwell for the next 45° .
 - (c) Follower to return to its original position during next 90° .
 - (d) Follower to dwell for the rest of the cam rotation. The displacement of the follower is to take place with simple harmonic motion during both the outward and return strokes. The least radius of cam is 50 mm. If the cam rotates at 300 rpm, determine the maximum velocity and acceleration of the follower during the outward stroke and return stroke.
6. The cranks of a two cylinder uncoupled inside cylinder locomotive are at right angles and are 300 mm long. The distance between the centre lines of the cylinders is 650 mm. The wheel centre lines are 1.6 m apart. The reciprocating mass per cylinder is 300 kg. The driving wheel diameter is 1.8 m. If the hammer blow is not to exceed 45 kN at 100 km/hr, determine
- (a) the fraction of the reciprocating masses to be balanced,
 - (b) the variation in tractive effort, and
 - (c) the maximum swaying couple.

7. Write short notes on any **two** of the following : $2 \times 7 = 14$

- (a) Inversions of single slider kinematic chain
 - (b) Turning moment diagram and its use for design of flywheel
 - (c) Dynamically equivalent system
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