

B.E./B.TECH Degree Examination, December 2020

Third Semester

AE18306 – Mechanics of Machines

(Regulation 2018)

Time: Three hours

Maximum :80 Marks

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. A completely constrained motion can be transmitted with.....
 - (a) 1 link with pin joints
 - (b) 2 link with pin joints
 - (c) 3 link with pin joints
 - (d) 4 link with pin joints
2. The product of the diametral pitch and circular pitch is equal to
 - (a) 1
 - (b) $1/\pi$
 - (c) π
 - (d) 2π
3. A circle drawn with centre as the cam centre and radius equal to the distance between the cam centre and the point on the pitch curve at which the pressure angle is maximum, is called
 - (a) base circle
 - (b) pitch circle
 - (c) prime circle
 - (d) none of these
4. In an engine, the work done by inertia forces in a cycle is
 - (a) positive
 - (b) zero
 - (c) negative
 - (d) none of these
5. Suggest the suitable equation to identify a kinematic chain.
6. How to evaluate the mating of two gears?
7. Choose the best suitable clutches used in two wheelers.
8. How would you explain D'Alembert's principle?

PART B - (4 X16 = 64 marks)

09. (a) Identify any two inversion of a double slider crank chain mechanism: Explain with neat sketches. (16)

(OR)

- (b) The crank and connecting rod of a theoretical steam engine are 0.5m and 2m long respectively. The crank makes 180 rpm in the clockwise direction, when it has turned 45 degrees from the inner dead centre position. Find (16)
1. Velocity of the piston.
 2. Angular velocity of the connecting rod.
 3. Velocity of point E on the connecting rod 1.5 m from the gudgeon pin
10. (a) (i) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio. (10)
- (ii) The following data relate to a pair of 20° Involute gears in mesh: (6)
- Module = 6 mm, Number of teeth on pinion = 17, Number of teeth on gear = 49; Addendum on pinion and gear wheel = 1 module. Find the number of pairs of teeth in contact

(OR)

- (b) In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. (16)
- (i) If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B.
- (ii) If the gear A instead of being fixed makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B?
11. (a) A centrifugal clutch is to transmit 15 kW at 900 r.p.m. The shoes are four in number. The speed at which the engagement begins is $\frac{3}{4}$ th of the running speed. The inside radius of the pulley rim is 150 mm and the centre of gravity of the shoe lies at 120 mm from the centre of the spider. The shoes are lined with Ferrodo for which the coefficient of friction may be taken as 0.25. Determine: 1. Mass of the shoes, and 2. Size of the shoes, if angle subtended by the shoes at the centre of the spider is 60° and the pressure exerted on the shoes is 0.1 N/mm^2 . (16)

(OR)

(b) A cam is to give the following motion to a knife-edged follower: **(16)**

1. Outstroke during 60° of cam rotation; 2. Dwell for the next 30° of cam rotation; 3. Return stroke during next 60° of cam rotation, and 4. Dwell for the remaining 210° of cam rotation.

The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft

12. (a) A vertical double acting steam engine has a cylinder 300 mm diameter and 450 mm stroke and runs at 200 r.p.m. The reciprocating parts have a mass of 225 kg and the piston rod is 50 mm diameter. The connecting rod is 1.2 m long. When the crank has turned through 125° from the top dead centre, the steam pressure above the piston is 30 kN/m^2 and below the piston is 1.5 kN/m^2 . Calculate the effective turning moment on the crankshaft. **(16)**

(OR)

(b) A small connecting rod 220 mm long between centers has a mass of 2 kg and a moment of inertia of 0.02 kg-m^2 about its centre of gravity. The centre of gravity is located at a distance of 150 mm from the small end centre. Determine the dynamically equivalent two mass system when one mass is located at the small end centre. **(16)**

If the connecting rod is replaced by two masses located at the two centers, find the correction couple that must be applied for complete dynamical equivalence of the system when the angular acceleration of the connecting rod is 20000 rad/s^2 anticlockwise.