Roll No ....

ME-3003-CBGS

B.E. III Semester

Examination, December 2020

Choice Based Grading System (CBGS)
Theory of Machines and Mechanisms

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

      ii) All questions carry equal marks.

1. a) Explain the completely constraint, in completely constraint and successfully constraint motion.

   b) Explain how are Whitworth quick return mechanism and crank and slotted lever mechanism are different from each other?

2. a) State and explain Three center in line theorem.

   b) A reciprocating engine has a stroke of 40cm and connecting rod four times the crank. At the instant, the crank has turned through an angle of 30° from the inner dead centre. The crank rotates at 240 rpm clockwise and has an acceleration of 1140 cm/sec^2. Determine:

      i) Velocity and acceleration of the piston

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

3. a) State and prove the law of gearing. Show that involute profile satisfies the conditions for correct gearing.

b) A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact.

4. a) How the velocity ratio of epicyclic gear train is obtained by tabular method?

   b) Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft A. A compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. The gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B. Sketch the arrangement and find the number of teeth on internal gear G assuming that all gears have the same module. If the shaft A rotates at 110 r.p.m, find the speed of shaft B.

5. Derive expressions for the velocity and acceleration of the follower when it moves with simple harmonic motion.

6. a) What do you mean by gyroscopic couple? Derive a relation for it's magnitude.

   b) Discuss the effect of gyroscopic couple on the stability of a four wheeler while negotiating a turn.

7. Determine critical speed of the car when it takes a right turn of 100m radius. Following are the input data for calculation mass of car = 2000kg, wheel base = 2.4m, track width = 1.4m. The centre of gravity = 500mm above ground level on the vertical line through geometric centre of wheels. Diameter of wheels = 800mm, mass moment of inertia of each wheel = 1 kg m^2, rear axle ratio = 4, mass moment of inertia of engine rotating parts = 3 kg m^2. The spin axis of wheels and engine parts are parallel and rotation is in same sense.

8. Write short note on : (any two)
    i) Davis and Ackermann's steering mechanism
    ii) Hook's joint
    iii) Classification of gears
    iv) Procedure of torque calculation in epicyclic gear train

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