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Univ. Roll No.....

Program: B.Tech. (Batch 2018 onward)

Semester: 4th

Name of subject: Theory of Machines

Subject Code: PCME-106

Paper ID: 16195

MORNING

21 SEP 2022

Time Allowed: 3 Hours

Max. Marks: 60

NOTE:

- 1) Parts A and B are compulsory
- 2) Part C has Two questions Q8 and Q9. Both are compulsory, but with internal choice.
- 3) Any missing data may be assumed appropriately

Part – A

[Marks: 02 each]

Q1.

- a) Define kinematic pair.
- b) Explain law of gearing.
- c) Explain the concept of free body diagram.
- d) Give classification of cams.
- e) What is hammer blow explain its effects?
- f) Explain use of idle pulley.

Part- B

[Marks: 04 each]

- Q2.** Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form; module = 6 mm, addendum = one module, pressure angle = 20°. The pinion rotates at 90 r.p.m. Determine: **1.** The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel, **2.** The length of path and arc of contact.
- Q3.** Explain the procedure to find torque acting on crank for single slider crank mechanism using free body diagram.
- Q4.** A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter, running at 250 r.p.m. The angle embraced is 165° and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, density of leather 1 Mg/m³ and thickness of belt 10 mm, determine the width of the belt taking centrifugal tension into account.
- Q5.** A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively, and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190°, both being measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine: **1.** The magnitude of the masses at A and D **2.** the distance between planes A and D. **3.** The angular position of the mass at D.

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- Q6. Describe with the help of a neat sketch the principles of operation of an internal expanding shoe.
- Q7. Explain the concept of balancing of secondary forces of multi-cylinder In-line engines

Part- C

[Marks: 12 each]

- Q8. A cam drives a flat reciprocating follower in the following manner: During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam.

OR

Describe any three inversions of double slider crank chain with neat sketches.

- Q9. In a four bar mechanism PQRS, the link PS is fixed. The length of the links are: PQ = 62.5 mm ; QR = 175 mm ; RS = 112.5 mm and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Find the angular velocity and angular acceleration of the links QR and RS for the values of angle QPS at an interval of 60° .

OR

Two shafts A and B are co-axial. Gear C having 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.

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