Exam No: _____

# GANPAT UNIVERSITY
## B. TECH SEM- III (ME/MC/ME-Int.) ENGINEERING
## CBCS REGULAR EXAMINATION– NON/DEC - 2016
## 2ME302 Kinematics of Machines

**TIME: 3 HRS** **TOTAL MARKS: 60**

**Instructions:** (1) This Question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate full marks.
(3) Assume suitable data if necessary.

## SECTION: I

**Q.1**

(A) Explain with the help of a neat sketch working of a Rope brake dynamometer. **(04)**

(B) For a single block brake as shown in **Figure – 1,** the brake drum is 300 mm and angle of contact is 80°. The effort applied at the free end of the lever is 800 N. The coefficient of friction between the drum and block is 0.5. Determine the braking torque required and projected area of the block if bearing pressure is 0.45 N/mm$^2$. **(06)**

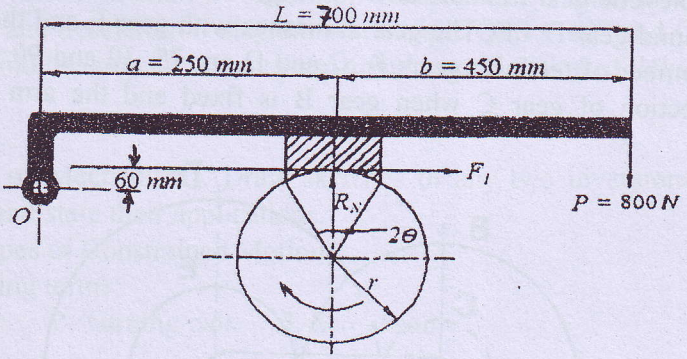


**Figure – 1**

**OR**

**Q. 1**

(A) Explain with the help of a neat sketch working of a Single block of shoe brake. **(04)**

(B) A torsion dynamometer is fitted on a turbine shaft to measure the angle of twist. It is observed that the shaft twists 2° in length of 20 m at 120 rpm. The shaft is hollow with 300 mm internal and 400 mm external diameters. What will be the power of the turbine? If a hollow shaft is replaced by a solid shaft with 350 mm diameter, what will be the power of the turbine? Take G = 80 GPa. **(06)**

**Q.2**

(A) Derive an expression for frictional torque of a conical pivot bearing assuming uniform wear theory. **(04)**

(B) A thrust shaft of a ship has 6 collars of 300 mm external radius and 150 mm internal radius. The total thrust from the propeller is 100 kN. If the coefficient of friction is 0.12 and speed of the engine 90 rpm. Find the power absorbed in friction at the thrust block, assuming (i) Uniform Pressure, and (ii) Uniform wear. **(06)**

**OR**

**Q.2**

(A) Derive the expression for the external force required to move up a weight W on an incline plane. Also give physical interpretation when (i) Friction angle is greater than slop, (ii) Friction angle is less than or equal to slop. **(04)**

(B) The trust of a propeller shaft in a marine engine is taken up by a number of collars, integral with the shaft of 300 mm diameter. The axial thrust is 20 kN and the speed is 75 rpm. Taking $\mu = 0.05$ and uniform intensity of pressure as 0.3 N/mm$^2$, find the external dia. of the collar and number of collars required if the power lost in friction is not to exceed 16.5 kW. **(06)**

Q.3

(A) Describe the Watt's parallel mechanism for straight line motion and drive the condition under which the straight line is traced. (03)

(B) A cam rotating clockwise with a uniform speed of 300 rpm is to give the roller follower of 15 mm diameter the following motion: (07)

(i) Follower to rise through a distance of 45 mm during 120 ° cam rotation,

(ii) Follower to dwell for 60° cam rotation,

(iii)Follower to return to its initial position during next 120° of cam rotation,

(iv)Follower to dwell for remaining period of 60° of cam rotation.

The minimum radius of the cam is 30 mm and the line of stroke of the follower is offset by 15 mm from the axis of the cam and the displacement of the follower is to take place with Uniform Velocity motion on both rise and return strokes. Draw the Cam Profile.

## SECTION: II

Q.4

(A) Enlist different type of gear train. Explain compound gear train with neat sketch. Also derive the equation of the velocity ratio for compound gear train. (04)

(B) In a reverted epicyclic gear train as shown in **Figure – 2**, the arm A carries two gears B and C and a compound gear D - E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 r.p.m. clockwise. (06)

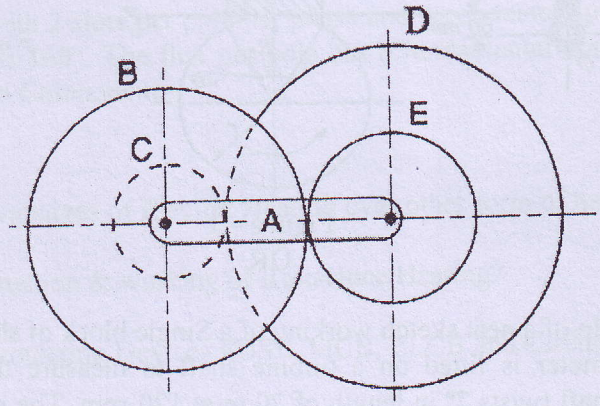


**Figure – 2**

**OR**

Q.4

(A) Define the following terms: (04)

1. Link 2. Higher Pair 3. Kinematic chain 4. Degrees of freedom

(B) An epicyclic gear consists of three gears A, B and C as shown in **Figure – 3**. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the center of A at 18 rpm. If the gear A is fixed, determine the speed of gears B and C. (06)

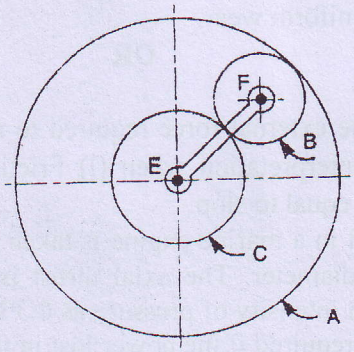


**Figure – 3**

Q.5 The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively as shown in **Figure – 4**. The crank makes 180 r.p.m. in the clockwise direction. When it has turned 45° from the inner dead center position, determine: 1. velocity of piston, 2. angular velocity of connecting rod, 3. velocity of point E on the connecting rod 1.5 m from the gudgeon pin, 4. velocities of rubbing at the pins of the crank shaft, crank and crosshead when the diameters of their pins are 50 mm, 60 mm and 30 mm respectively, 5. position and linear velocity of any point G on the connecting rod which has the least velocity relative to crank shaft. **(10)**

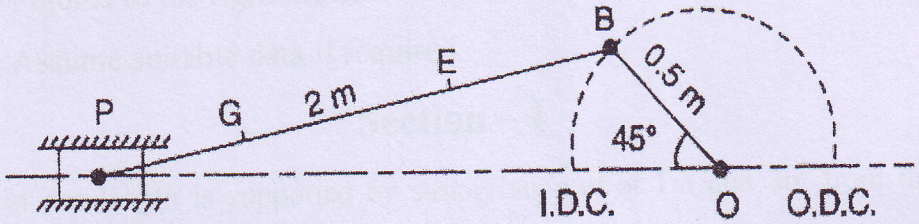


**Figure – 4**

**OR**

Q.5 PQRS is a four bar chain with link PS fixed. The lengths 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. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS. **(10)**

Q.6

(A) Define "Inversion of Mechanism". Draw sketches of any two inversions of double slider crank mechanism and state their applications. **(04)**

(B) Describe briefly types of Constrained Motions. **(03)**

(C) Explain the following terms: **(03)**

1. Sliding pair 2. Turning pair 3. Screw pair

----------**END OF PAPER**----------