

Roll No.

Total No. of Pages : 03

Total No. of Questions : 09

B.Tech.(ME) (2011 onwards)
B.Tech.(Marine Engineering) (2013 Onwards)
(Sem.-3)

THEORY OF MACHINES-I

Subject Code : BTME-302

Paper ID : [A1139]

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. **SECTION-A** is **COMPULSORY** consisting of **TEN** questions carrying **TWO** marks each.
2. **SECTION-B** contains **FIVE** questions carrying **FIVE** marks each and students has to attempt any **FOUR** questions.
3. **SECTION-C** contains **THREE** questions carrying **TEN** marks each and students has to attempt any **TWO** questions.

SECTION-A

1. Write briefly :

- (a) Explain why higher pair cannot be inverted.
- (b) Write the conditions of coriolis acceleration.
- (c) Draw the diagram of pantograph.
- (d) Write the equation of correct steering.
- (e) What is law of belting?
- (f) Which motion of follower is preferred for high speed engines?
- (g) Which are the applications of centrifugal clutch?
- (h) Explain coefficient of steadiness.
- (i) Explain power of governor.
- (j) Write the applications of cone clutch.

SECTION-B

2. In a quick return mechanism of the oscillating link type as shown in Fig.-1, the distance between the fixed centers AC is 80 mm and the length of driving crank BC is 20 mm. Determine the time ratio of the working stroke to the return stroke.

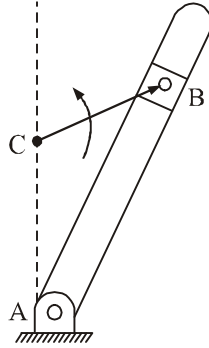


Fig.1

3. Explain the effect of friction in power transmission. The diameter of the brake drum of a single block brake as shown in Fig-2 is 1 m. It sustains 240 N-m of torque at 400 *r.p.m.* The coefficient of friction is 0.32. Determine the required force to be applied when the rotation of drum is clockwise and angle of contact is 35° . Given that $a = 800$ mm, $b = 150$ mm, $c = 25$ mm. Also find the value of c for self-locking.

$a = 800\text{mm}$
 $b = 150\text{mm}$
 $c = 20\text{mm}$
 $r = 0.5\text{m}$

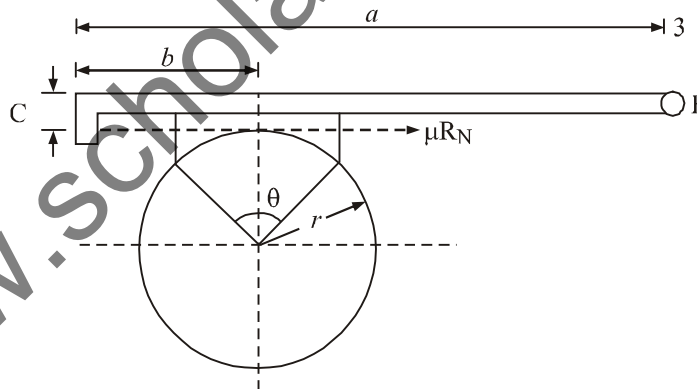


Fig.-2

4. In a four bar mechanism ABCD, AD is fixed and is 120 mm long. The crank AB is 30 mm long and rotates at 100 *r.p.m.* clockwise, while the link CD = 60 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60° .
5. What is the difference between Ackerman and Davis steering mechanism? Explain.

- The width of a belt is 15 cm and the maximum tension per cm width is not to exceed 140 N. The ratio of tensions on the two sides is 2.25, the diameter of the driver is 1.05 m and it makes 220 rpm. Find the power that can be transmitted.

SECTION-C

- Draw displacement, velocity and acceleration diagram for simple harmonic motion of follower with cam.
- An engine develops 200 kW at a mean speed of 100 *r.p.m.* The coefficient of fluctuation of speed is $\pm 2\%$ of mean speed and coefficient of fluctuation of energy is 0.10. Knowing the mean diameter of flywheel rim as 2.0 m, density as 7200 kg/m³ and the hub and spokes provide 5% of the rotational inertia of the flywheel, find the mass and cross-sectional area of the flywheel rim.
- A spring controlled governor with auxiliary spring has the mass of each ball as 2 kg. Minimum radius is 10 cm and the maximum 15 cm. Minimum speed is 250 *r.p.m.* and maximum 5% greater than minimum. The combined stiffness of the two ball spring is 0.6 N/cm. Find the equivalent stiffness of auxiliary spring. Assume vertical and horizontal length of arms as 12 cm and 10 cm respectively.