

Code: 9A21506

R09

B.Tech III Year I Semester (R09) Supplementary Examinations December 2015

MECHANISMS & MECHANICAL DESIGN

(Aeronautical Engineering)

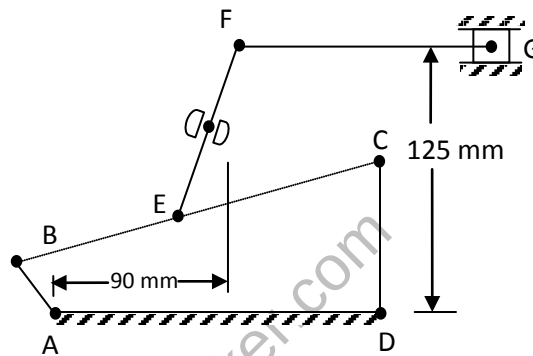
Time: 3 hours

Max. Marks: 70

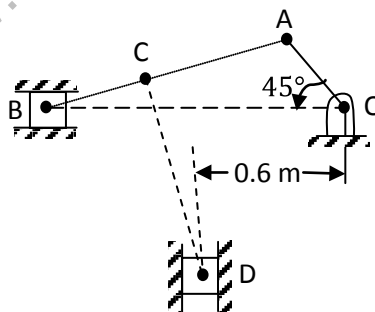
Answer any FIVE questions

All questions carry equal marks

- 1 (a) Define 'Kinematic pair'. Explain different types of kinematic pairs.
(b) What is an inversion of a kinematic chain? Explain inversions of single slider crank chain with practical applications.
- 2 The dimensions of various links in a mechanism, as shown below are as follows:
AB = 25 mm; BC = 175 mm; CD = 60 mm; AD = 150 mm; BE = EC; and EF = FG = 100 mm.
The crank AB rotates at 200 r.p.m. When the angle BAD is 135°, determine:
(a) Acceleration of G
(b) Angular acceleration of EF, and



- 3 The lengths of various links of a mechanism, as shown in figure below are: OA = 0.3 m; AB = 1 m; CD = 0.8 m; and AC = CB. Determine, for the given configuration, the velocity of the slider D if the crank OA rotates at 60 r.p.m. in the clockwise direction. Also find the angular velocity of the link CD. Use instantaneous centre method.



- 4 (a) A ship is pitching a total angle of 150, the oscillation may be taken as simple harmonic and the complete period is 32 seconds. The turbine rotor mass is 600 kg, its radius of gyration is 450 mm and it is rotating at 2400 r.p.m. Calculate the maximum value of gyroscopic couple set by the rotor and its effect, when the bow is descending and the rotor is rotating clockwise looking from aft. What is the maximum angular acceleration to which the ship is subjected to while pitching?
(b) Derive from the first principles an expression of the gyroscopic couple.

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- 5 The roller following a cam moves with SHM during ascent and with uniformly accelerated and decelerated motion during descent. The cam rotates at 370 rpm. Draw the cam profile for the following data:

Least radius of cam = 60 mm

Angle of ascent = 54°

Angle of dwell between ascent and descent = 48°

Angle of descent = 66°

Life of the follower = 50 mm

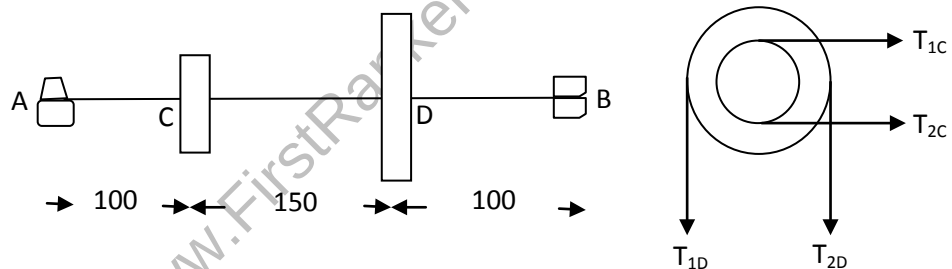
Roller diameter = 30 mm

Offset of follower axis = 20 mm towards right.

Determine the maximum velocity and acceleration of follower during ascent and descent.

- 6 Derive the expressions for displacement, velocity and acceleration for a circular arc cam operating a flat-faced follower.
- (a) When the contact is on the circular flank.
- (b) When the contact is on circular nose.

- 7 The layout of a shaft is as shown in figure below. Pulley D (diameter 480 mm) drives the shaft, while pulley C (diameter 150 mm) transmits power to a compressor. The belt tensions for pulley C are 1500 N and 600 N. The ratio of belt tensions for pulley D is 3.5. Find the shaft diameter as per A.S.M.E. code. Yield strength and ultimate tensile strength for shaft material are 380 MPa and 720 MPa respectively. Assume $K_b = 1.75$ and $K_t = 1.25$.



- 8 An epicyclic train is composed of a fixed annular wheel A having 150 teeth. Meshing with A is a wheel B which drives wheel D through an idle wheel C, D being concentric with A. Wheels B and C are carried on an arm which revolves clockwise at 100 rpm about the axis of A or D. If the wheel B and D are having 25 and 40 teeth respectively, find the number of teeth of C and the speed and sense of rotation of C.
