

16172

3 Hours / 100 Marks

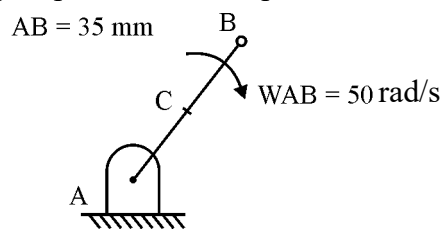
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- Instructions :**
- (1) All Questions are *compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
 - (8) Use of steam tables, logarithmic, Mollier's chart is permitted.

Marks**1. Answer any TEN of the following :****20**

- (a) Define inversion with example.
- (b) List the inversions for double slider crank mechanism.
- (c) Define sliding pair with example.
- (d) Define centripetal and tangential acceleration.
- (e) Find the velocity of point B and midpoint C of link AB shown in Figure (1).

**Fig. 1**

- (f) Classify the cam.
- (g) Define following terms with respect to cam and follower :
 - (i) Prime circle
 - (ii) Pitch circle
 - (iii) Pressure angle
 - (iv) Trace point

- (h) What are the limitations of knife edge follower ?
- (i) List the methods to reduce the slip in belt and pulley.
- (j) Write down the formula of length of belt for open belt drive and cross belt drive.
- (k) Define law of gearing.
- (l) Define self-energizing and self-locking brake.
- (m) What are the limitations of shoe brake ?
- (n) Define uniform wear theory and uniform pressure theory.
- (o) State effects of imbalance in machine.

2. Solve any FOUR of the following :

16

- (a) Draw a neat sketch and explain working of beam engine.
- (b) Explain with neat sketch how to find the velocity of a slider in slider crank mechanism by Klein's construction.
- (c) Draw and explain in short, types of followers used in cam and follower.
- (d) Explain condition for maximum power transmission.
- (e) Explain the compound gear train with neat sketch and write down the velocity ratio's equation.
- (f) A multiplate clutch has three pairs of contact surfaces. The outer and inner radii of the contact surfaces are 100 mm and 50 mm respectively. The maximum axial spring force is limited to 1.25 kN. If the co-efficient of friction is 0.35 and assuming uniform wear, find the power transmitted by the clutch at 1600 rpm.

3. Answer the following questions (any FOUR) :

16

- (a) Differentiate between mechanism and machine.
- (b) Explain the working of Whitworth quick return mechanism.
- (c) In slider crank mechanism, the length of crank OB and connecting rod AB are 130 mm and 500 mm respectively. The centre of gravity G of the connecting rod is 275 mm from slider A. The crank speed is 750 rpm in clockwise. When crank has turned 45° from inner dead centre position determine (i) velocity of slider 'A' (ii) velocity of centre of gravity of connecting rod 'G'.

- (d) Find the width of the belt, necessary to transmit 7.5 kW to a pulley 300 mm diameter, if the pulley makes 1600 rpm and the co-efficient of friction between the belt and pulley is 0.3. Assume the angle of contact as 180° and the maximum tension in the belt is not to exceed 8 N/mm width.
- (e) Explain the working of Watt governor with neat diagram.
- (f) Explain the working of centrifugal clutch with neat sketch.

4. Answer any FOUR of the following :

16

- (a) Explain the working of freewheel mechanism of bicycle with sketch.
- (b) In a four bar mechanism ABCD link AD is fixed and the crank AB rotates at 10 radians per second in clockwise, lengths of the links are $AB = 60$ mm, $BC = CD = 70$ mm, $DA = 120$ mm, when angle $DAB = 60^\circ$ and both B and C lie on the same side of AB, find angular velocities of BC and CD link.
- (c) What are the advantages of 'V' belt drive over flat belt drive ?
- (d) Explain the working of flywheel with the help of turning moment diagram.
- (e) Explain the working of internal expanding brake with neat sketch.
- (f) A shaft has number of collars integral with it. The external diameter of the collars is 400 mm and the shaft diameter is 250 mm. If the uniform intensity of pressure is 0.35 N/mm² and its co-efficient of friction is 0.05; find (i) power absorbed in overcoming friction when shaft rotates at 105 rpm and carries a load of 150 kN, and (ii) number of collars required.

5. Answer any TWO of the following :

16

- (a) A cam with 40 mm minimum diameter rotates in clockwise at uniform speed and has to give the following motion to a roller follower 15 mm diameter :
 - (i) Follower to complete outward stroke of 40 mm during 120° of cam rotation with uniform velocity.
 - (ii) Follower to dwell for 60° of cam rotation.
 - (iii) Follower will return to its initial position during 120° of cam rotation with uniform acceleration and retardation.
 - (iv) Follower will dwell for remaining 60° of cam rotation.Draw the profile of cam, if the axis of follower passes through the axis of cam.
- (b) In the toggle mechanism as shown in Fig. (2), D is constrained to move on a horizontal path. The dimensions of various links are $AB = 200$ mm,

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$BC = 300$ mm, $OC = 150$ mm and $BD = 450$ mm. The crank OC is rotating in a counter clockwise direction at a speed of 180 rpm. Find, for given configuration (1) velocity and (2) acceleration of 'D'.

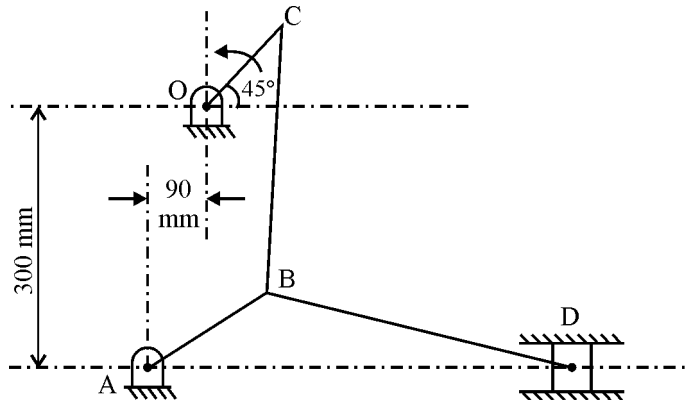


Fig. 2

- (c) A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter running at 250 rpm. The angle of contact is 165° and the co-efficient of friction between the belt and the pulley is 0.35. If the safe working stress for the leather belt is 2 MPa, density of leather is 1050 kg/m^3 and the thickness of belt is 10 mm, determine the width of belt, taking centrifugal tension into account.

6. Answer any FOUR of the following :

16

- Draw a neat sketch of Oldham's coupling and explain the working of it.
- Define following terms :
Fluctuation of energy, co-efficient of fluctuation of energy, co-efficient of fluctuation speed, maximum fluctuation of energy.
- Explain the working of rope brake dynamometer with neat sketch.
- Explain the working of single plate clutch with neat diagram.
- State reasons for balancing of rotating elements of machine. Explain balancing concept.
- Four masses A, B, C and D are attached to a shaft and revolve in the same plane. The masses are 12 kg, 10 kg, 18 kg and 15 kg respectively and their radii of rotations are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of the masses B, C and D are 60° , 135° and 270° from the mass 'A'. Find the magnitude and position of the balancing mass at a radius of 100 mm. Use graphical method only.