

CBCS SCHEME

15MT45

Fourth Semester B.E. Degree Examination, June/July 2019 Theory of Machines

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define the following:
- i) Degrees of freedom
 - ii) Inversion
 - iii) Structure
- (06 Marks)
- b. With a neat sketch explain:
- i) Any two inversion of four bar chain
 - ii) Geneva wheel.
- (06 Marks)
(04 Marks)

OR

- 2 a. With a neat sketch, explain Ratchet and Pawl mechanism. (08 Marks)
- b. A four bar mechanism ABCD is made up of four links, pin jointed at the ends. AD is fixed link which is 180mm long. The links AB, BC and CD are 90mm, 120mm and 120mm long respectively. At certain instant, the link AB makes an angle of 60° with the link AD. If the link AB rotates at a uniform speed of 100rpm clockwise determine:
- i) Angular velocity of the links BC and CD
 - ii) Angular acceleration of the links CD and CB.
- (08 Marks)

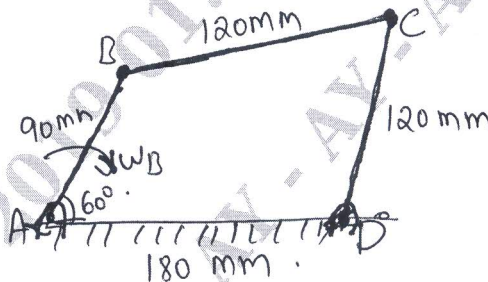


Fig.Q.2(b)

Module-2

- 3 a. Explain Law of Gearing. (06 Marks)
- b. A pinion of 20° involute teeth rotating at 275 rpm meshes with a gear and provides a gear ratio of 1.8. The number of teeth on the pinion is 20 and the module is 8mm. If the interference is just avoided, determine:
- i) The addendum on the wheel and pinion
 - ii) The path of contact
 - iii) The maximum velocity of sliding on both sides of the pitch point.
- (10Marks)

OR

- 4 a. Explain different types of Gear trains. (06 Marks)
- b. An epicyclic gear train is shown in Fig.Q.4(b). The number of teeth on A and B are 80 and 200. Determine the speed of the arm a
- If A rotates at 100rpm clockwise and B at 50rpm counter clockwise.
 - If A rotates at 100 rpm clockwise and B is stationary.

(10 Marks)

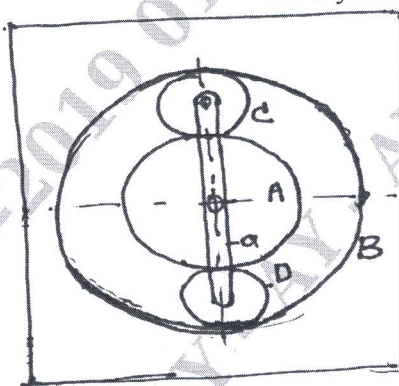


Fig.Q.4(b)

Module-3

- 5 A cam with 25mm has minimum radius is rotating in clockwise at a uniform speed of 100rpm and has to give the motion to the knife edge follower as defined below:
- Follower to move outwards through 24mm during 120° of cam rotation.
 - Follower to dwell for next 60° .
 - Follower to return to its starting position during next 90° .
 - The displacement of the follower takes place with UARM on both outward and return stroke.
- Draw the cam profile when (i) follower axis passes through the axis of the cam. (16 Marks)

OR

- 6 A cam rotating clockwise at uniform speed of 300rpm operates a reciprocating follower through a roller 1.5cm diameter. The follower motion is defined as below:
- Outward during 150° with UARM
 - Dwell for next 30°
 - Return during next 120° with SHM
 - Dwell for the remaining period stroke of the follower is 3cm. Minimum radius of the cam is 3cm. Draw the cam profile when follower axis passes through cam axis.

(16 Marks)

Module-4

- 7 A shaft carries 4 rotating masses A, B, C and D in third order along the axis. The mass A may be assumed to be concentrated at 160mm radius, B at 180mm, C at 200mm and D at 120mm radius. The masses B, C and D are 40, 30 and 50kg respectively. The planes containing B and C are 300mm apart. The angular spacing of C and D are 90° and 210° respectively with respect to B measured in the same direction. If the shaft and masses are to be in complete dynamic balance determine:
- Mass and angular position of A
 - Position of planes A and D.

(16 Marks)

OR

- 8 a. Sketch and explain the types of Belt drives. (06 Marks)
- b. A belt which is embracing 165° of a pulley of effective diameter 1000mm is transmitting 10kW. The pulley is running at 250rpm. The coefficient of friction is 0.3. Mass of belt material is 0.0012gm/mm^3 , thickness of belt = 10mm. Considering centrifugal tension, find width of belt, safe working stress = 1.5MPa. Also determine the initial tension in the belt drive. (10 Marks)

Module-5

- 9 a. Define the following terms:
i) Governor ii) Hunting iii) Stability. (06 Marks)
- b. Each arm of a porter governor is 300mm long and is pivoted on the axis of the governor, Each ball has a mass of 6kg and the mass of sleeve is 18kg. The radius of rotation of ball is 200mm, when the governor begins to lift and 250mm when the speed is maximum Determine the maximum and minimum speed and the range of speed of governor. (10 Marks)

OR

- 10 a. Define the following:
i) Gyroscope
ii) Gyroscopic couple
iii) Sensitiveness. (06 Marks)
- b. A ship is propelled by a turbine rotor which has a mass of 5000kg and has a speed of 2100rpm. The rotor has a radius of gyration of 0.5m and rotates in clockwise direction when viewed from stern. Find the gyroscopic effect in the following conditions:
i) The ship runs at a speed of 16 knots (1 knot = 1860 m/hr). It steers to the left in a curve of 60m radius.
ii) The ship pitches 6° above and 6° below the horizontal position. The bow descends with its maximum velocity. The motion due to pitching is SHM and the periodic time is 20sec.
iii) The ship rolls at a certain instant has an angular velocity of 0.03 rad/sec clockwise when viewed from the stern. (10 Marks)
