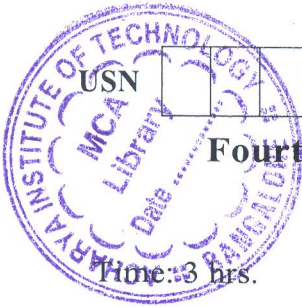


# CBCS SCHEME

17MT45



## Fourth Semester B.E. Degree Examination, July/August 2022 Theory of Machines

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- 1 a. Explain Inversion of Single slider crank mechanism with neat sketch. (10 Marks)
- b. Explain the Inversion of four bar chain mechanism. (10 Marks)

OR

- 2 a. Explain classification of Kinematic pair. (10 Marks)
- b. Explain Crank and Slotted level quick return motion. (10 Marks)

### Module-2

- 3 a. Explain Law of Gearing with neat sketch. (10 Marks)
- b. Derive an expression for minimum number of teeth on the wheel in order to avoid interference. (10 Marks)

OR

- 4 a. An epicyclic gear consists of three gears A, B and C as shown in Fig.Q4(a). The gear 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 centre of A at 18 rpm. If the gear A is fixed, determine the speed of gear B and C. (10 Marks)

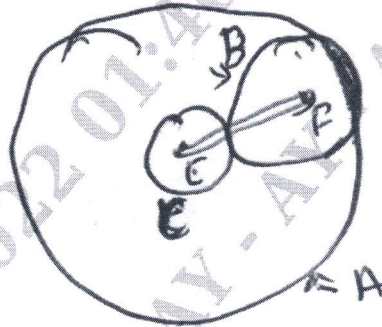


Fig. Q4(a)

- b. What are types of gear train? Explain briefly with respective formula derived for that with diagram. (10 Marks)

### Module-3

- 5 a. Explain the different types of followers. (05 Marks)
- b. A cam with 3cm as minimum radius is rotating clockwise at a uniform speed of 1200rpm and has to give the motion to the knife edge follower as defined below :
  - i) Follower to move outward through 3cm during 120° of cam radius with SHM.
  - ii) Dwell for the next 60°.
  - iii) Follower to return to its starting position during next 90° with UARM.
  - iv) Dwell for the remaining period. Draw the cam profile when follower axis passes through cam axis. (15 Marks)

OR

- 6 A cam rotating clockwise at a uniform speed of 1000rpm is required to give a roller follower the motion defined below :
- Follower to move outward through 50mm during  $120^\circ$  of cam rotation.
  - Follower to dwell for next 60 of cam rotation.
  - Follower to return to its starting position during next  $90^\circ$  of cam rotation.
  - Follower to dwell for the rest of cam rotation.

The minimum radius of the cam is 50mm and the diameter of roller is 10mm. The line of stroke of the follower is off-set by 20mm from the axis of the cam shaft. If the displacement of the follower takes place with uniform and equal acceleration and retardation on both outward and return strokes, draw profile of the cam and find the maximum velocity and acceleration during out stroke and return stroke. (20 Marks)

**Module-4**

- 7 a. Four masses  $M_1$ ,  $M_2$ ,  $M_3$  and  $M_4$  are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotations are 0.2 m, 0.15m, 0.25m and 0.3 m respectively and the angle between successive masses are  $45^\circ$ ,  $75^\circ$  and  $135^\circ$ . Find the position and magnitude of balance mass required, if its radii of rotation is 0.2 m in both analytical and graphical method. (10 Marks)
- b. A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the masses of B, C and D are 10 kg, 5 kg and 4 kg respectively. Find the required masses A and the relative angular settings of the four masses so that the shaft shall be in complete balance. The angle between  $BD = 100^\circ$ ,  $BC = 240^\circ$ . (10 Marks)

OR

- 8 a. An open belt running over two pulleys 240 mm and 600 mm diameter connects the parallel shaft 3m apart and transmits 4 KW from the smaller pulley that rotates at 300 rpm. Coefficient of friction between the belt and the pulleys is 0.3 and the safe working tension is 10 N per mm width. Determine : i) Minimum width of the belt ii) Initial belt tension iii) Length of the belt required. (10 Marks)
- b. i) Derive the expression for centrifugal tension of the flat belt drive and ii) Condition for the transmission of maximum power. (10 Marks)

**Module-5**

- 9 a. Explain effect of Gyroscopic couple on a naval ship during steering with neat sketch. (10 Marks)
- b. Derive the expression for stability of a two wheel vehicle taking a turn. (10 Marks)

OR

- 10 In a spring loaded governor of the hartnell type, the mass of each ball is 5 kg and the lift of the sleeve is 50 mm. The speed at which the governor begins to float is 240 rpm and at this speed the radius of ball path is 110 mm. The mean working speed of the governor is 20 times the range of speed when friction is neglected. If the length of ball and roller arm of the bell crank lever are 120 mm and 100 mm respectively and if the distance between the center of pivot of bell crank lever and axis of governor spindle is 140 mm, determine the initial compression of the spring taking into account the obliquity arms. If friction is equivalent to a force of 30 N at the sleeve. Find the total alteration in speed before the sleeve begins to move from mid position. (20 Marks)

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