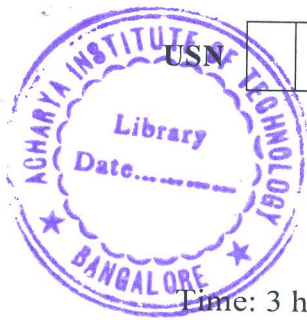


CBCS SCHEME



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17MT45

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

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 sketches. (10 Marks)
- b. A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and contact ratio. (10 Marks)

OR

- 4 a. An epicyclic train of gears is arranged as shown in Fig.Q4(a). How many revolutions does the arm, to which is pinions B and C are attached make
 - i) When A makes one revolution clockwise and D makes half a revolution anticlockwise and
 - ii) When A makes one revolution clockwise and D is stationary.The number of teeth on the gears A and D are 60 and 105 respectively.

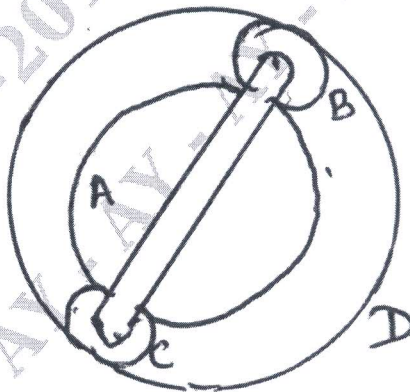


Fig.Q4(a)

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. The Fig.Q4(b) shows diagrammatically a compound epicyclic gear train wheels A, D and E are free to rotate independently on spindle O, while B and C are compound and rotate together on spindle P, on the end of arm OP. All the teeth on different wheels have the same module. A has 12 teeth, B has 30 teeth and C has 14 teeth cut externally. Find the number of teeth on wheels D and E which cut internally. If the wheel A is driven clockwise at 1 RPS. While D is driven counter clockwise at 5 RPS. Determine the magnitude and direction of the angular velocities of ARM OP and wheel E.

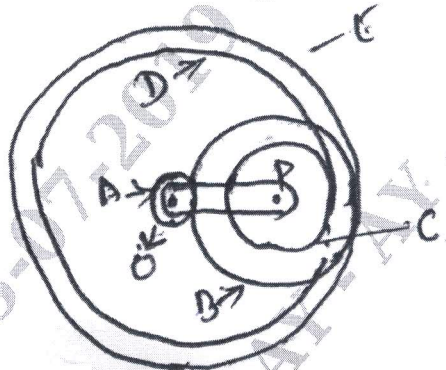
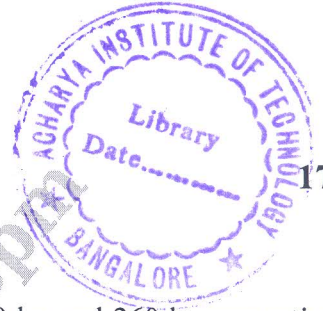


Fig.Q4(b)

(10 Marks)

Module-3

- 5 A cam is to give the following motion to a knife edged follower:
1. Outstroke during 60° of cam rotating
 2. Dwell for next 30° of cam rotation
 3. Return stroke for next 60° of cam rotation
- Dwell for remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. the follower moves with uniform velocity during the outstroke and simple harmonic during the return strokes. Draw the profile of the cam:
- i) The axis of the follower passes through axis of the cam shaft.
 - ii) The axis of the follower is offset by 20 mm from the axis of the cam shaft.
 - iii) Draw the displacement, the velocity and the acceleration diagram for one complete revolution of the cam.
- (20 Marks)
- OR**
- 6 Draw the profile of the cam when the roller follower moves with cycloidal motion during out stroke and return stroke as given below:
1. Out stroke with maximum displacement of 31.4 mm during 180° of cam rotation.
 2. Return stroke for next 150° of cam rotation.
 3. Dwell for remaining 30° of cam rotation.
- i) Draw the profile of cam with minimum radius of 15 mm and roller diameter 10 mm. the axis of the roller follower is offset by 10 mm towards right the axis of cam shaft.
 - ii) Draw a cam of 25 mm radius and roller of 10 mm diameter at axis of cam shaft.
- (20 Marks)



17MT45

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° , 75° and 135° . 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. The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a speed of 3000 rpm/ Clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship.
i) When the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h.
ii) When the ship is pitching in a simple motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12° . (12 Marks)
- b. Explain the effect of gyroscopic couple of an Aeroplane. (08 Marks)

OR

- 10 a. What are different types of governor? Derive the expression for speed of process governor. (08 Marks)
- b. A porter governor has all four arms 250 mm long. The upper arms are attached on the axis of rotation and the lower arms are attached to the sleeve at a distance of 30 mm from the axis. The mass of each ball is 5 kg and the sleeve has a mass of 50 kg. The extreme radii of rotation are 150 mm and 200 mm. Determine the range of speed of the governor. (12 Marks)

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