18MT45

Fourth Semester B.E. Degree Examination, June/July 2023
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. Define the following:
   i) link   ii) Kinematic pairs. **(04 Marks)**
   b. Explain difference between machine and structure. **(04 Marks)**
   c. List different types of inversions of four benchain mechanism and with neat sketch explain any one. **(12 Marks)**

OR

2 a. Explain with neat sketch Geneva wheel mechanism and Ratchet Pawl mechanism. **(10 Marks)**
   b. With neat sketch, explain Ackerman steering gear. **(10 Marks)**

Module-2

3 a. Define the following with respect to spur gear:
   i)   Circular pitch
   ii)   Module
   iii) Path of approach
   iv)   Path of races
   v)   Addendum
   vi)   Dedendum. **(09 Marks)**
   b. Derive length of one of contact in spur gear. **(11 Marks)**

OR

4 a. A spur gear of 20° pressure angle running at 200rpm drives another gear at a speed of 100rpm. The center distance between the two gears is 300mm and module is 5mm. Determine:
   i)   Pitch circle radius of pinion on gear
   ii)   Number of teeth on gear and pinion
   iii) Base circle radius of gear and pinion
   iv)   Circular pitch
   v)   Tooth thickness of pitch circle. **(08 Marks)**

b. An epicyclic gear train consists of a Sunwheel (S), a stationary internal gear (E) and three identical wheels (P) carried on a star shaped planet carrier (C). The size of the different toothed wheels are such that the planet carrier (C) rotates at 1/5 of the Sunwheel. The minimum number of teeth on any wheel is 16. The driving torque on the sun wheel is 100N/m is shown in Fig.Q.4(b). Determine:
i) Number of teeth on different wheels of train.
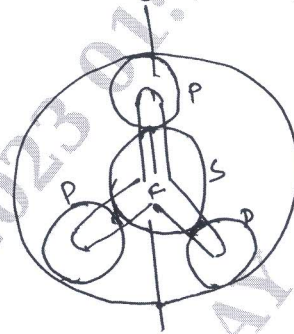ii) Torque necessary to keep the internal gear stationary. **(12 Marks)**

Fig.Q.4(b)

Module-3

5 a. Explain different types of Cams. **(05 Marks)**
b. Construct the profile of a cam rotating clock wise least radius of cam – 20mm
Diameter of roller (follower) - 10mm
Angle of lift - 120° with UARM
Angle of fall - 120° with SHM
Angle between lift and fall - 30°
Cam speed - 300rpm
Stroke of follower – 30mm
i) In-line follower
ii) Find the maximum velocity and acceleration during lift and fall. **(15 Marks)**

OR

6 a. Explain different types of followers. **(05 Marks)**
b. Draw the cam profile with roller of 25mm diameter attached to the follower to give lift of 35mm. Axis of the follower and offset to the right of cam axis by 18mm. A scent of the follower takes place with SHM is 0.05 sec followed by a period of rest of 0.0125 sec. The follower then descends with UARM during 0.125 sec. and the remaining period rests at the minimum lifted position. The cam rotates in clockwise direction at a constant speed of 240rpm and the base circle radius is 50mm.
i) Find the maximum velocity and acceleration during lift and fall. **(15 Marks)**

Module-4

7 a. Define static and dynamic balancing. **(04 Marks)**
b. Derive balancing of single revolving mass in two different planes, both the masses are on the same plane. **(10 Marks)**
c. Explain different types of belt drives. **(06 Marks)**

OR

8 a. Derive centrifugal tension in belt drive. **(05 Marks)**
   b. Four masses M_1 = 100kg, M_2 = 175kg, M_3 = 200kg and M_4 = 125kg are fixed to the crank of 200mm radius and revolve in planes 1, 2, 3 and 4 respectively. The angular position of the planes 2, 3 and 4, with respect to are 75°, 135°, 240° taken in the same sense. Distance of the planes 2, 3 and 4 from 1 are 600mm, 1800mm and 2400mm. Determine the magnitude and position of the balancing marks at radius 600mm in planes '1' and 'M' located in the middle of 1 and 2 and in the middle of 3 and 4 respectively. **(15 Marks)**

Module-5

9 a. Derive gyroscopic couple on disc. **(06 Marks)**
   b. Find the angle of inclination with respect to the vertical of a two wheeler negotiating a turn given combined mass of vehicle with rides = 250kg. Mass moment of inertia for the engine flywheel = $0.3 kg/m^2$ and moment of inertia of each road wheel = $1 kg/m^2$, speed of engine flywheel 5 times that of road wheels and in the same direction, height of center of gravity of rides with vehicle 0.6m, two wheeler speed 90km/hr. wheel radius 300mm and radius of turn = 50m. **(14 Marks)**

OR

10 a. Define the following:
   i)   Sensitiveness
   ii) Governor effort
   iii) Governor power
   iv) Hunting
   v)   Isochronous governor
   vi) Centripetal force. **(06 Marks)**
   b. In a porter governor the arms and links are each 10cm long and intersect on the main axis. Mass of each ball is 9kg and the central load/mass is 40kg. When the sleeve is in its lowest position the arms are inclined at 30° to the axis, the lift of the sleeve is 2cm. What is the force of friction at the sleeve? If the speed at the beginning of ascend from the lowest position is equal to the speed at beginning of descend from the highest position. What is range of speed of governor, if all other things remains same. **(14 Marks)**

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