CBCS Scheme

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15MT45

Fourth Semester B.E. Degree Examination, June/July 2018
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) Link ii) Kinematic pair
iii) Degrees of freedom iv) Kinematic chain **(04 Marks)**

b. Explain inversion of single slider crank mechanism with neat sketch. **(06 Marks)**

c. What is intermittent motion? Explain Ratchet and Pawl mechanism. **(06 Marks)**

OR

2 a. In a four bar mechanism (chain) ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 rpm clockwise while the link CD is 80 mm oscillates about D BC and AD are equal length. Find the angular velocity of link CD when angle BAD = 60°. Draw velocity diagram (relative velocity method). **(08 Marks)**

b. The Fig.Q2(b) shows the crank of a slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and the connecting rod 600 mm long. Determine angular velocity and angular acceleration of the connecting rod at a crank angle of 45° from innerdead center position by graphical method.

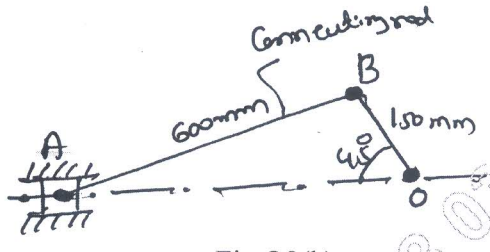

Fig.Q2(b) **(08 Marks)**

Module-2

3 a. Explain gear terminology with a neat sketch. **(08 Marks)**

b. Explain the following: (i) Law of gearing, (ii) Path of contact. **(08 Marks)**

OR

4 An epicyclic gear train consists of three gears A, B and C as shown in Fig.Q4. The gear 'A; 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 center of 'A' at 18 rpm. If the gear A is fixed, determine the speed of gears B and C.

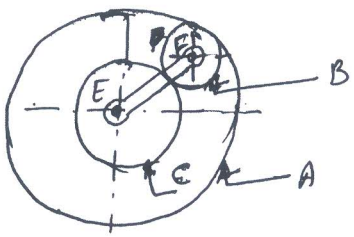

Fig.Q4 **(16 Marks)**

Module-3

5 A cam is to be designed for a knife edge follower with the following data:
i) Cam lift = 40 mm during 90° of cam rotation in rising with simple harmonic motion.
ii) Dwell for the next 30°.
iii) During the next 60° of cam rotation the follower returns to its original position with simple harmonic motion.
iv) Dwell during remaining 180°.
Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft. Determine maximum velocity of the follower during follower ascent and descending if cam rotates at 240 rpm. **(16 Marks)**

OR

6 Construct a profile of a cam to suite the following specifications.
Cam shaft diameter = 40 mm Least radius of cam = 25 mm
Diameter of roller = 25 mm Angle of lift = 120°
Angle of fall = 150° Lift of the follower = 40 mm
Numbers of pauses are two of equal interval between motions. During the lift the motion is SHM. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is offset 12.5 mm from the center of the cam. **(16 Marks)**

Module-4

7 a. Define static and dynamic balancing and state the condition. **(04 Marks)**
b. A shaft carries four masses A, B C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in x and y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm. Find their magnitudes and angular positions. **(12 Marks)**

OR

8 a. Derive the expression for centrifugal tension of flat belt drive. **(06 Marks)**
b. An open belt drive connects two parallel shafts 1.2 m apart. The driving and the driven shafts rotate at 350 rpm and 140 rpm respectively and driven pulley is 400 mm diameter. The belt is 5 mm thick and 80 mm wide. The coefficient of friction between the belt and pulley is 0.3m and maximum permissible tension in the belting is 1.4 MN/m^2. Determine:
i) Diameter of driving pulley.
ii) Maximum power that may be transmitted by the belting.
iii) Required initial belt tension. **(10 Marks)**

Module-5

9 a. Explain the effect of the gyroscopic couple on an aeroplane. **(08 Marks)**
b. An aeroplane makes a complete half circle of 50 m radius towards left when flying at 200 km per hr. The rotary engine and the propeller of the plane has a mass of 400 kg and a radius of gyration of 0.3 m. The engine rotates at 2400 rpm clockwise when viewed from the rear. Find the gyroscopic couple on the air craft and state its effect on it. **(08 Marks)**

OR

10 a. What are the different types of governors? Explain the watt governor with neat sketch. **(08 Marks)**
b. A porter governor has equal arms each 250 mm long and pivoted on axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 15 kg. The radius of rotation of ball is 150 mm when the governors begins to lift and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor. **(08 Marks)**