

CBCS SCHEME

15AE44

Fourth Semester B.E. Degree Examination, July/August 2021 Mechanisms and Machine Theory

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

1. a. What is the significance of degree of freedom of kinematic chain when it functions as a mechanism? Give examples. (06 Marks)
- b. Sketch and describe the working of any one of two different types of quick return mechanism. Give examples of their applications. Derive an expression for the ratio of time taken in forward and return stroke for one of these mechanism. (10 Marks)
2. a. What is the condition for correct steering? Sketch and show the two main types of steering gears and discuss their relative advantages. (10 Marks)
- b. Sketch a pantograph, explain its working and show that it can be used to reproduce to an enlarged scale in a figure. (06 Marks)
3. An engine mechanism is shown in Fig.Q3. The crank $CB = 100$ mm and the connecting rod $BA = 300$ mm. With centre of gravity G , 100 mm from B . In the position shown, the crank shaft has a speed of 75 rad/s and an angular arc elevation of 1200 rad/s². Find:
 - (i) Velocity of G and angular velocity of AB .
 - (ii) Acceleration of G and angular acceleration of AB .

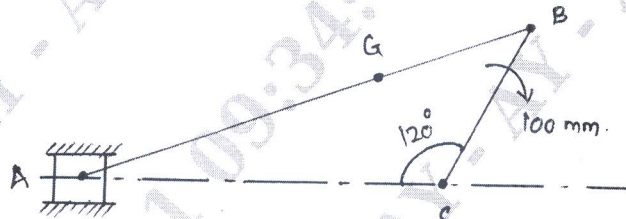


Fig.Q3

(16 Marks)

4. a. A four link mechanism with the following dimensions is acted upon by a force 80 N $\angle 150^\circ$ on the link DC .
 $AD = 500$ mm; $AB = 400$ mm; $BC = 1000$ mm; $DC = 750$ mm; $DE = 350$ mm
 Determine the input torque T on the link AB for the static equilibrium of the mechanism for the given configuration.

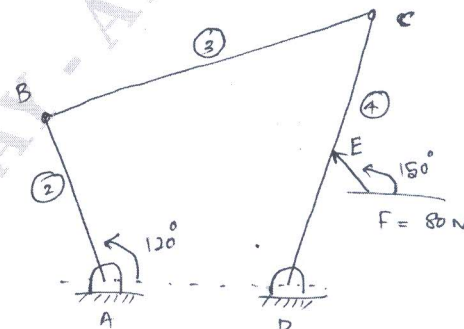


Fig.Q4(a)

(10 Marks)

- b. Explain briefly about the principle of virtual work with neat sketch. (06 Marks)

- 5 a. With the help of neat sketch, state and prove the Law of gearing. (06 Marks)
 b. A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of smaller being 2000 rpm. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at pitch point, and at the point of disengagement if smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact. (10 Marks)
- 6 In an epicyclic gear train, the internal wheels A and B and compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C and F gears with B and D. All the wheels have same module and the number of teeth are; $T_C = 28$, $T_D = 26$; $T_E = T_F = 18$.
 (i) Sketch the arrangement
 (ii) Find the number of teeth on A and B
 (iii) If the arm G makes 100 rpm, clockwise and A is fixed, find the speed of B.
 (iv) If the arm G makes 100 rpm clockwise and wheel A makes 10 rpm counter clock wise, find the speed of wheel B. (16 Marks)
- 7 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 mass of B, C and D are 10 kg, 5 kg and 4 kg respectively.
 Find the required mass A and the relative angular settings of the four masses so that shaft shall be in complete balance. (16 Marks)
- 8 a. Write short notes on primary and secondary balancing. (06 Marks)
 b. Derive the following expressions for an uncoupled two cylinder locomotive engine;
 (i) Variation in tractive force
 (ii) Swaying couple
 (iii) Hammer blow (10 Marks)
- 9 a. What is the function of a governor? How does it differ from that of a flywheel? (08 Marks)
 b. Define and explain the following terms relating to governors:
 (i) Stability
 (ii) Sensitiveness
 (iii) Isochronism
 (iv) Hunting (08 Marks)
- 10 a. (i) Write a short note on gyroscope.
 (ii) What do you understand by gyroscopic couple?
 Derive a formula for its magnitude. (10 Marks)
 b. Explain briefly about the effect of the gyroscopic couple on an aeroplane. (06 Marks)
