Total No. of printed pages = 2

ME 181503

Roll No. of candidate

24/2/22   2021

B.Tech. 5th Semester End-Term Examination

ME, IPE

MECHANISMS AND DYNAMICS OF MACHINES

(New Regulation & New Syllabus)

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any *four* from the rest.

1. (a) What is Corioli's acceleration? Give some examples where Corioli's acceleration is found. $(5 \times 2 = 10)$

    (b) Differentiate between kinematic analysis and kinematic synthesis.

    (c) What is inversion of a mechanism?

    (d) Explain the cause of gyroscopic couple.

    (e) What is the need of balancing of engines and machines?

2. Crank O_2A rotates at 300 rpm in CCW direction. Find velocity and acceleration of all the links.   (15)

Here O_1O_2=200 mm
O_1B=300 mm
O_2A= 60 mm
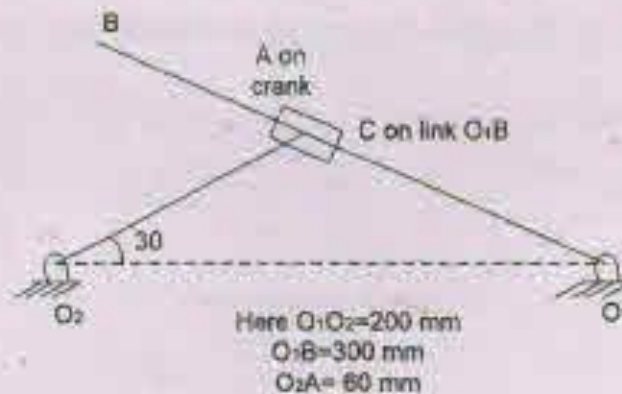
3. (a) Discuss Chebyshev's spacing of precision points to minimize errors.

    (b) Design a slider crank mechanism so that the displacement of the slider is proportional to the crank rotation in the interval $40° \leq \theta \leq 100°$. Initial distance of the slider is 20 cm and final distance is 15 cm. $(5 + 10 = 15)$

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4. (a) Differentiate between mechanism and a machine

    (b) Differentiate between binary, ternary and quaternary links.

    (c) Discuss movability and Gruebler's equation and their application in case of a mechanism.

    (d) Explain the working principle of a steering gear mechanism.

    $$(2 + 3 + 5 + 5 = 15)$$

5. (a) What are the effects and applications of gyroscopic couple? Give examples.

    (b) The mass of a turbine rotor of a ship is 4000 kg, radius of gyration is 0.5 m and its speed is 3000 rpm clockwise when looking from stern. Determine the gyroscopic couple and its effect on the ship:

       (i) When the ship is steered to the left on a curve of 105 m radius at a speed of 35 km/hr.

       (ii) When the ship is pitching in SHM, the bow falling with maximum velocity. The period of pitching is 45 sec and total angular displacement between the two extreme positions of pitching is 15°. $(5 + 10 = 15)$

6. A rotating shaft carries four masses A, B, C and D in that order. The mass centres are 30 mm, 38 mm, 40 mm, 35 mm respectively from the axis of rotation. The masses A, C and D are 7.5 kg, 5 kg and 4 kg respectively. The axial distance between A and B is 600 mm and between B and C is 500 mm. The masses A and C are at right angles to each other. For complete balance, find magnitude of mass B, axial distance between C and D and angular positions of B, D and A.   (15)

7. (a) Explain hammer blow, tractive effort and swaying couple of a locomotive.

    (b) A V-twin engine has the cylinder axes at right angles and the connecting rods operate a common crank. The reciprocating mass per cylinder is 10 kg, the crank radius is 80 mm and the length of connecting rod is 0.4 m. Show the engine may be balanced for primary forces by a rotating balance mass.

    $$(6 + 9 = 15)$$