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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, June-2017

SUBJECT: THEORY OF MACHINES [MTE 2201]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. What do you understand by inversion of mechanism? With a neat sketch elaborate on an inversion of a Double slider crank mechanism, widely used for generating elliptical profile. **(04)**

1B. A thrust shaft of a ship has 6 collars of 600 mm external diameter and 300mm internal diameter. The total thrust from the propeller is 100 KN. If the coefficient of friction is 0.12 and speed of the engine 90 RPM, find the power absorbed in friction at the thrust block, assuming (a). Uniform pressure; and (b). Uniform wear. **(04)**

1C. Why there is need to balance the rotating masses? List the various ill effects of unbalanced rotating masses in machineries. **(02)**

2A. A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below : (i). To move outwards through 40 mm during 100° rotation of the cam ; (ii). To dwell for next 80° ; (iii). To return to its starting position during next 90°, and (iv). To dwell for the rest period of a revolution i.e. 90°. Draw the profile of the cam,when the line of stroke of the follower passes through the centre of the cam shaft and the displacement of follower has uniform acceleration and retardation. **(05)**

2B. Fig. 2B. Shows an epicyclic gear train. Pinion A has 15 teeth and is rigidly fixed to the motor shaft. The wheel B has 20 teeth and gears with A and also with the annular fixed wheel E. Pinion C has 15 teeth and is integral with B (B, C being a compound gear wheel). Gear C meshes with annular wheel D, which is keyed to the machine shaft. The arm rotates about the same shaft on which A is fixed and carries the compound wheel B, C. If the motor runs at 1000 RPM, find the speed of the machine shaft. Find the torque exerted on the machine shaft, if the motor develops a torque of 100 N-m. **(05)**

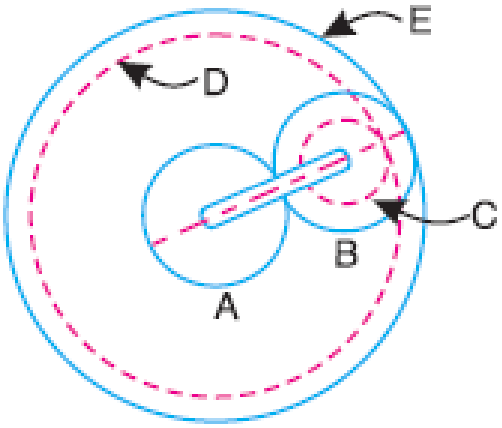

Fig. 2B : Epicyclic Gear Train.

3A. In an I.C engine mechanism is shown in Fig. 3A. 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 crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s^2. Find (i). Velocity of G and angular velocity of AB, and (ii). Acceleration of G and angular acceleration of AB. **(06)**

Fig. 3A: I.C. engine Mechanism

3B. Five masses M_1, M_2, M_3, M_4 and M_5 revolve in the same plane. Magnitudes of M_1, M_2 and M_3, are 5, 2.5 and 4kg, respectively. Angular positions ofM_2, M_3, M_4 and M_5 are 60°, 135°, 210° and 270° from M_1 determine the masses M_4 and M_5 when system is dynamically balanced. Assume all masses revolve at equal radii of 1m. **(04)**

4A. A cam follower has uniform acceleration and retardation motion. Derive an expression for its Maximum velocity and acceleration during its out stroke and return stroke. **(04)**

4B. Define Grashof's law. Discuss all the possible cases for a four-bar mechanism with all the four links of unequal length satisfying Grashof's law. **(03)**

4C. What are the different types of constrained motion? Elaborate on each type with a suitable example. **(03)**

5A. For the kinematic linkages shown in the Fig 5A. Calculate the number links, joints and degrees of freedom. **(06)**

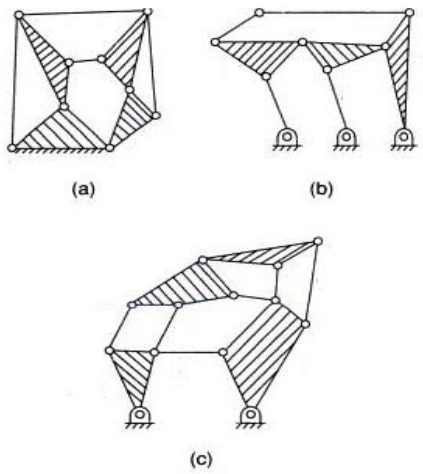

Fig.5A: Kinematic Linkages

5B. Derive an expression for perfect steering and in detail explain the Ackermann steering gear mechanism. **(04)**