

B.Tech. Degree IV Semester Examination in Marine Engineering
May 2019

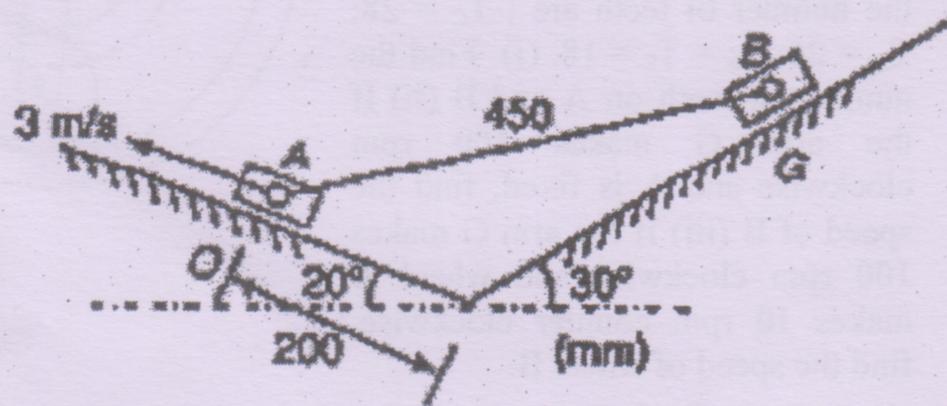
MRE 1401 MECHANICS OF MACHINERY
(2013 Scheme)

Time: 3 Hours

Maximum Marks: 100

(5 × 20 = 100)

- I. (a) State and prove Arnold Kennedy's theorem of three centres. (10)
(b) Describe the inversions of double slider crank chain with the help of neat sketches. (10)
- OR
- II. For the given mechanism shown in figure, find the velocity of slider B, if the velocity of slider A is 3 m/s. (20)



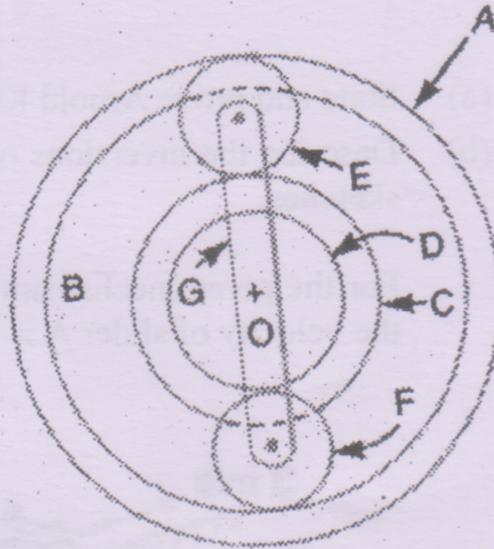
- III. Draw the profile of a cam operating a roller follower with the following data. Minimum radius of cam = 25 mm, Lift = 30 mm, Roller diameter = 15 mm. The cam lifts the follower for 120° with SHM followed by a dwell period of 30° . Then the follower lowers down during 150° of cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a speed of 150 rpm, calculate maximum velocity and acceleration of follower during descent period. (20)
- OR
- IV. A symmetrical circular cam having flat faced follower with a lift of 30 mm; minimum radius of cam = 50 mm, nose radius = 12 mm, speed = 210 rpm, Angle of lift = 80° . Find the main dimensions of cam and acceleration of follower (i) at beginning of lift (ii) the end of contact with the circular flank (iii) the beginning of contact with nose (iv) the apex of nose. (20)
- V. (a) Explain the terms sensitiveness, hunting, stability, isochronism related to governors. (10)
(b) Explain the working of a Proell governor with a neat sketch. (10)
- OR
- VI. In a spring-loaded Hartnell type of governor, the mass of each ball is 4 kg and the lift of the sleeve is 40 mm. The governor begins to float at 200 rpm when the radius of ball path is 90 mm. The mean working speed of governor is 16 times range of speed when friction is neglected. The length of the ball and roller arms of the bell crank lever are 100 mm and 80 mm respectively. The pivot centre and the axis of governor are 115 mm apart. Determine the initial compression of spring, taking into account the obliquity of arms. Assuming friction at sleeve to be equivalent to a force of 15 N, determine total alteration in speed before sleeve begins to move from the mid-position. (20)

(P.T.O.)

- VII. (a) Two 20° involute spur gears mesh externally and give a velocity ratio of 3. The module is 3 mm and addendum is equal to 1.1 module. If the pinion rotates at 120 rpm, determine (i) the minimum number of teeth on each wheel to avoid interference (ii) contact ratio. (10)
- (b) State and prove law of gearing. (6)
- (c) Explain the terms addendum, dedendum, module and circular pitch. (4)

OR

- VIII. 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 the same module and the number of teeth are : $T_C = 28$; $T_D = 26$; $T_E = T_F = 18$. (i) Find the number of teeth on A and B (ii) If the arm G makes 100 rpm clockwise and A is fixed, find the speed of B (iii) If the arm G makes 100 rpm clockwise and wheel A makes 10 rpm counter clockwise, find the speed of wheel B. (20)



- IX. (a) The following data refer to an internal expanding shoe brake. Force 'F' on each shoe = 180 N; friction coefficient = 0.3; internal radius of brake drum = 150 mm; width of brake lining = 40 mm; distance $a = 200$ mm; $c = 120$ mm; angles $\theta_1 = 30^\circ$, $\theta_2 = 135^\circ$. Determine the braking torque applied when drum rotates (i) counterclockwise (ii) clockwise. (15)
- (b) What is meant by a self-locking and a self-energised brake? (5)

OR

- X. 2.5 kW of power is transmitted by an open belt drive. The linear velocity of the belt is 2.5 m/s. The angle of lap on the smaller pulley is 165° . The coefficient of friction is 0.3. Determine the effect on power transmission in the following cases: (20)
- Initial tension in the belt is increased by 8%
 - Angle of lap is increased by 8% by the use of idler pulley, for same speed and tension on tight side
 - Coefficient of friction is increased by 8% by suitably dressing the friction surface of belt
