

**B.Tech. Degree IV Semester Supplementary Examination in
Marine Engineering June 2022**

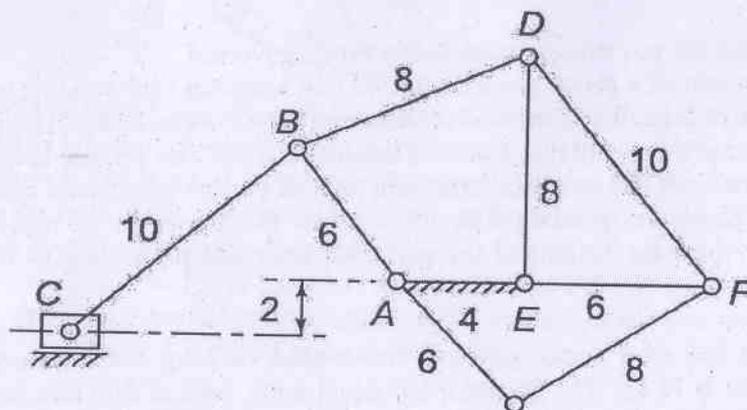
**MRE 1401 MECHANICS OF MACHINERY
(2013 Scheme)**

Time: 3 Hours

Maximum Marks: 100

(5 × 20 = 100)

- I. (a) Figure shows a plane mechanism in which the figures indicate the dimensions in standard units of length. The slider C is the driver. Will the link AG revolve or oscillate? (6)



- (b) Discuss about various inversions of a double slider crank chain and their practical applications. (14)

OR

- II. (a) In a slider-crank mechanism, the crank is 480 mm long and rotates at 20 rad/s in the counter-clockwise direction. The length of the connecting rod is 1.6 m. When the crank turns 60° from the inner-dead centre, determine the (20)
- Velocity of the slider
 - Velocity of a point E located at a distance of 450 mm on the connecting rod extended
 - Position and velocity of point F on the connecting rod having least absolute velocity
 - Angular velocity of the connecting rod
 - Velocities of rubbing at the pins of the crankshaft, crank and the cross-head having diameter of 80, 60, and 100 mm respectively.

- III. (a) A cam is to give the following motion to a knife-edged follower: (15)
- To raise the follower through 30 mm with uniform acceleration and deceleration during 120° rotation of the cam
 - Dwell for next 30° of the cam rotation
 - To lower the follower with simple harmonic motion during the next 90° rotation of the cam
 - Dwell for the rest of the cam rotation

The cam has a minimum radius of 30 mm and rotates counter-clockwise at a uniform speed of 800 RPM. Draw the profile of the cam if the line of stroke of the follower passes through the axis of the cam shaft.

- (b) Draw the displacement, velocity, and the acceleration diagrams of the above motions of the follower for one revolution of the cam indicating main values. (5)

OR

(P.T.O.)

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- IV. The following data relate to a cam operating an oscillating roller follower: (20)
- Minimum radius of the cam = 22 mm
 - Diameter of roller = 14 mm
 - Length of the follower arm = 40 mm
 - Distance of fulcrum centre from cam centre = 50 mm
 - Angle of ascent = 75°
 - Angle of descent = 105°
 - Angle of dwell for follower in the highest position = 60°
 - Angle of oscillation of follower = 28°

Draw the profile of the cam if the ascent and descent both take place with SHM.

- V. (a) Derive the governing equation of a Proell governor. (10)
- (b) Each arm of a Proell governor is 240 mm long and each rotating ball has a mass of 3 kg. The central load acting on the sleeve is 30 kg. The pivots of all the arms are 30 mm from the axis of rotation. The vertical height of the governor is 190 mm. The extension links of the lower arms are vertical and the governor speed is 180 RPM when the sleeve is in mid-position. Determine the lengths of the extension links and the tension in the upper arms. (10)

OR

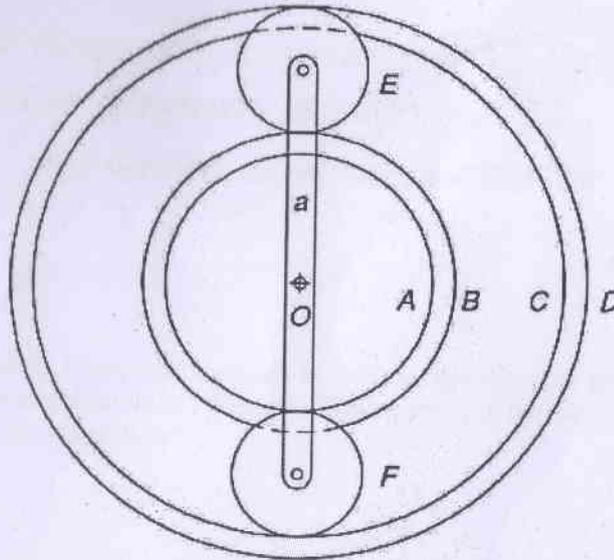
- VI. (a) Each ball of a Porter governor has a mass of 3 kg and the mass of the sleeve is 15 kg. The governor has equal arms, each of 200 mm length and pivoted on the axis of rotation. When the radius of rotation of the balls is 120 mm, the sleeve begins to rise up. The governor has a maximum speed at a radius of 160 mm. Determine the (12)
- (i) Range of speed
 - (ii) Lift of the sleeve
 - (iii) Effort of the governor
 - (iv) Power of the governor
- (b) What will be the effect on the above parameters if the friction at the sleeve is equivalent to 8 N. (8)
- VII. (a) Explain the law of gearing. (8)
- (b) Two 20° involute spur gears mesh externally and give a velocity ratio of 3. The module is 3 mm and the addendum is equal to 1.1 module. If the pinion rotates at 120 RPM, determine the (12)
- (i) Minimum number of teeth on each wheel to avoid interference
 - (ii) Contact ratio

OR

(Continued)

VIII.

(20)



In the epicyclic gear train shown above the compound wheels A and B as well as internal wheels C and D rotate independently about the axis O. The wheels E and F rotate on the pins fixed to the arm a. All the wheels are of the same module. The number of teeth on the wheels are $T_A = 52$, $T_B = 56$, $T_E = T_F = 36$. Determine the speed of C if

- (i) The wheel D is fixed and arm a rotates at 200 RPM clockwise.
- (ii) The wheel D rotates at 200 RPM counter-clockwise and the arm rotates at 20 RPM counter-clockwise.

- IX. (a) Derive the expression for exact and approximate lengths of the belt required for a crossed belt drive. (10)
- (b) Two parallel shafts, connected by a crossed belt, are provided with pulleys 480 mm and 640 mm in diameters. The distance between the centre lines of the shafts is 3 m. Find by how much the length of the belt should be changed if it is desired to alter the direction of rotation of the driven shaft without changing the direction of driver shaft. (10)

OR

- X. (a) With a neat diagram explain the working of a block/shoe brake. (15)
- (b) A bicycle and rider, travelling at 12 km/h on a level road, have a mass of 105 kg. A brake is applied to the rear wheel which is 800 mm in diameter. The pressure on the brake is 80 N and the coefficient of friction is 0.06. Find the distance covered by the bicycle and number of turns of its wheel before coming to rest. (5)

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B.Tech. Degree IV Semester Regular/Supplementary Examination in Marine Engineering June 2022

**19-208-0401 MECHANICS OF MACHINERY
(2019 Scheme)**

Time: 3 Hours

Maximum Marks: 60

Course Outcome

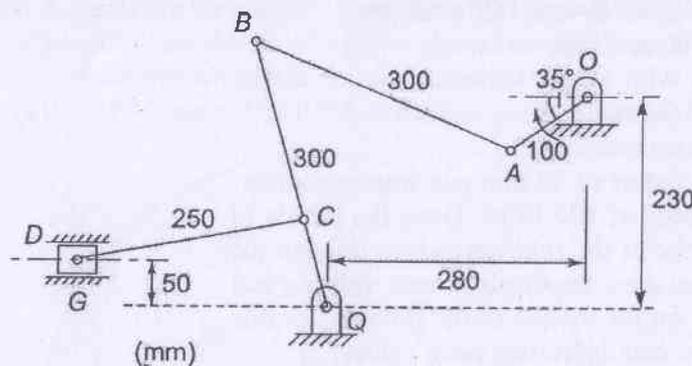
On successful completion of the course, the students will be able to:

- CO1: Understand the different kinematic chain and their inversions and analyse their kinematics.
 CO2: Analyze the different path generation mechanism and design cams and followers for specified motion profiles.
 CO3: Understand different types of governors and their characteristics.
 CO4: Evaluate gear tooth geometry and select appropriate gears for the required applications.
 CO5: Design belts and ropes, clutches, brakes and dynamometers for industrial applications.

Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze, L5 – Evaluate, L6 – Create

PO – Programme Outcome

- I. Figure shows a mechanism in which $OA = QC = 100$ mm, $AB = QB = 300$ mm, and $CD = 250$ mm. The crank rotates at 150 RPM in the clockwise direction. Determine the :
 (i) Velocity of the slider at D
 (ii) Angular velocities of links QB and AB
 (iii) Rubbing velocity at the pin B which is 40 mm in diameter



OR

(P.T.O.)