

**B.Tech. Degree IV Semester Supplementary Examination in  
Marine Engineering April 2021**

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

Time: 3 Hours

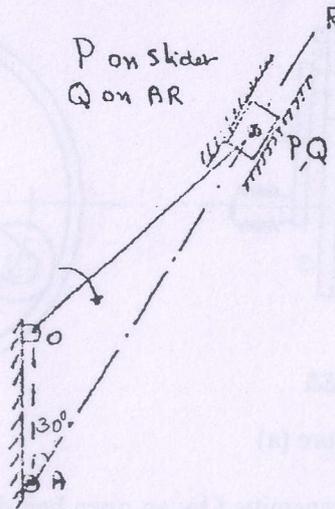
Maximum Marks: 100

(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. (a) Explain "Corioli's Component". (5)  
(b) One cylinder of a rotary engine is shown in configuration diagram. OA is the fixed crank, 200 mm long. OP is the connecting rod and is 520 mm long. The line of stroke is along AR and at the instant is inclined to the vertical at 30°. The body of the engine consisting of cylinders rotate at a uniform speed of 400 rpm about the fixed centre 'A'. Determine:  
(i) Acceleration of Piston (slider) inside the cylinder.  
(ii) Angular acceleration of the connecting rod.



- III. A cam is to be designed for knife edge follower with following data: (20)  
(i) Line of stroke is offset 20 mm from axis of cam shaft.  
(ii) Cam lift = 40 mm during 90° of cam rotation with SHM.  
(iii) Dwell for next 30°.  
(iv) During the next 60° of cam rotation the follower returns to its original position with SHM.  
(v) Dwell during remaining 180°.

Draw the profile of cam.

OR

- IV. (a) With neat sketches explain different types of Cams. (8)  
(b) Draw the profile of a cam operating a knife-edged follower having a lift of 30 mm. The cam raises the follower with SHM for 150° of its rotation followed by a period of dwell for 60°. The follower descends for the next 100° rotation of the cam with uniform velocity, again followed by a dwell period. The cam rotates at a uniform velocity of 120 rpm and has a least radius of 20 mm. What will be the maximum velocity and acceleration of the follower during the lift and the return?

(P.T.O.)

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- 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. (a) Distinguish between centrifugal governor and inertia governor. (5)  
 (b) Each arm of a Porter governor is 250 mm long. The upper and lower arms are pivoted to links of 40 mm and 50 mm respectively from the axis of rotation. Each ball has a mass of 5 Kg and the sleeve mass is 50 kg. The force of friction on the sleeve of the mechanism is 40 N. Determine the range of speed of the governor for extreme radii of rotation of 150 mm and 125 mm. (15)
- VII. (a) What are gear trains? Explain the different types of gear trains. (10)  
 (b) What do you mean by interference in involute gears? (5)  
 (c) Explain the terms addendum, dedendum, module and circular pitch. (5)
- OR**
- VIII. The annulus A in the gear shown rotates at 300 rpm about the axis of the fixed wheel 'S' which has 80 teeth. The three-armed spider (only one arm 'a' is shown in figure – (a)) is driven at 180 rpm, determine the number of teeth required on the wheel 'P'. (20)

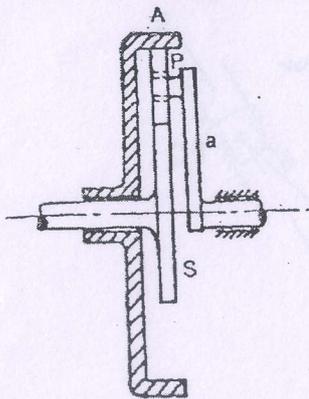


Figure (a)

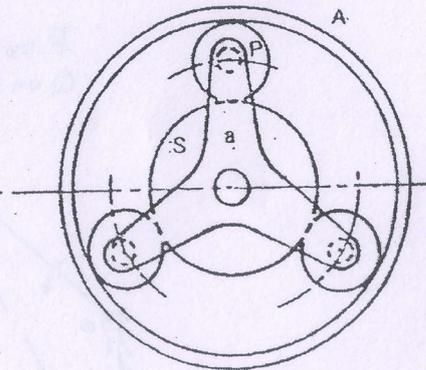


Figure (b)

- IX. 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  $165^\circ$ . 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 suitable dressing to friction surface of belt.
- OR**
- X. (a) Explain different types of brakes with suitable sketch. (8)  
 (b) A single plate clutch transmits 25 KW at 900 rpm. The maximum pressure intensity between the plate is  $85 \text{ kN/m}^2$ . The outer diameter of the plate is 360 mm. Both the sides of the plate are effective and the coefficient of friction is 0.25. Determine: (12)
- Inner diameter of the plate.
  - The axial force to engage the clutch.