



BT MRE – IV – 08 – 034

**B. Tech Degree IV Semester Examination in Marine Engineering
November 2008**

MRE 401 MECHANICS OF MACHINERY

Time : 3 Hours

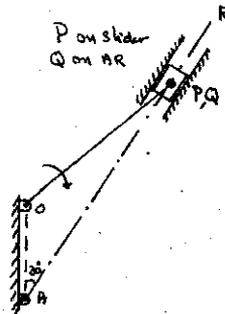
Maximum Marks : 100

(All questions carry EQUAL marks)

- I. (a) Explain kinematic chains and their classification.
(b) 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 1600 mm when the crank turns 60° from the inner-dead centre; determine
- The velocity of the slider
 - Velocity of a point 'E' located at a distance 450 mm on the connecting rod extended.
 - The position and velocity of a point 'F' on the connecting rod having the least absolute velocity.
 - The Angular velocity of the connecting rod.
 - The velocities of rubbing at the pins of the crank-shaft, crank and the cross-head having diameters 80, 60 and 100 mm respectively.

OR

- II. (a) Explain "Corioli's Component".
(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) Explain Pantograph with applications.
(b) Design a Pantograph for an indicator to be used to obtain the indicator diagram of an engine. The distance between the fixed point and the tracing point is 180 mm. The indicator diagram should be three times the gas pressure inside the cylinder of the engine.

OR

- IV. (a) With neat sketches explain different types of Cams.
(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?

(Turn Over)

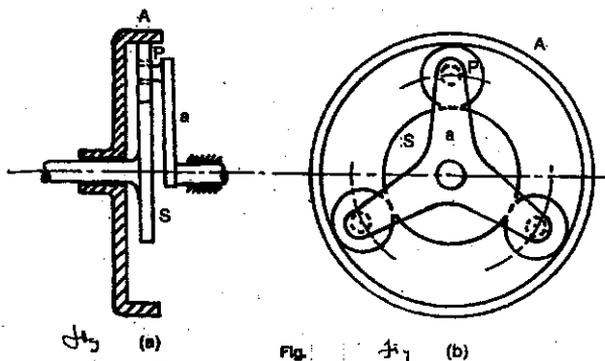
- V. (a) Distinguish between centrifugal governor and inertia governor.
 (b) Each arm of a Porter governor is 250 mm long. The upper and lower arms are pivoted to links of 40 mm and 50 mm respectively from the axis of rotation. Each ball has a mass of 5 Kg and the sleeve mass is 50 Kg. The force of friction 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.

OR

- VI. (a) Write notes on Governor Sensitivity, Stability and Hunting of Governors.
 (b) 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 the ball path is 90 mm. The mean working speed of the governor is 16 times the range of speed when friction is neglected. The lengths of the ball and roller arms of the ball-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 the spring, taking into account the obliquity of arms.
 Assuming the friction at the sleeve to be equivalent to a force of 15 N, determine the total alteration in speed before the sleeve begins to move from the mid-position.
- VII. (a) Two spur gears have a velocity ratio of $1/3$. The driven gear has 72 teeth of 8 mm module and rotates at 300 rpm. Calculate the number of teeth and speed of the driver? What will be the pitch line velocities?
 (b) The number of teeth of a spur gear is 30 and it rotates at 200 rpm. What will be its circular pitch and the pitch line velocity if it has a module of 2 mm?

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'.



- IX. A 100 mm wide and 10 mm thick belt transmits 5 KW between two parallel shafts. The distance between the shaft centers is 1.5 m and the diameter of the smaller pulley is 440 mm. The driving and driven shafts rotate at 60 rpm and 150 rpm respectively. Find the stress in the belt if the two pulleys are connected by (i) open belt (ii) cross belt. The coefficient of friction is 0.22.

OR

- X. (a) Explain different types of brakes with suitable sketch.
 (b) A single plate clutch transmits 25 KW at 900 rpm. The maximum pressure intensity between the plate is 85 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 (i) inner diameter of the plate (ii) the axial force to engage the clutch.