Exam.Code:0939
Sub. Code: 7043

1129

M.E. (Mechanical Engineering)
Third Semester
MEC-303: Theory of Machines – I

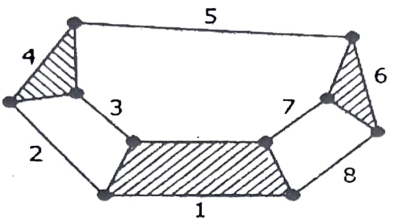
Time allowed: 3 Hours **Max. Marks: 50**

NOTE: *Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part.*

x-x-x

I. Attempt the following:-

Q1. (a) Differentiate between Centrifugal and inertia Governor.
(b) Explain construction and working of Elliptical Trammels with the help of neat sketch.
(C) Briefly describe turning moment diagram for multi-cylinder engine with help of neat sketch.
(d) Determine the degree of freedom of following mechanism:



(e) Briefly describe the phenomenon of slip in belts. (2×5 = 10 Marks)

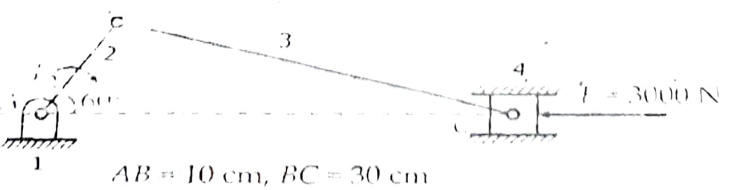
Part- A

Q2. PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm, QR = 175 mm, RS = 112.5 mm and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS. (10 Marks)

Q3. A three cylinder single acting engine has its cranks set equally at 120° and it runs at 600 r.p.m. The torque-crank angle diagram for each cycle is a triangle for the power stroke with a maximum torque of 90 N-m at 60° from dead centre of corresponding crank. The torque on the return stroke is sensibly zero. Determine: (a) power developed (b) Coefficient of fluctuation of speed, if the mass of the flywheel is 12 kg and has a radius of gyration of 80 mm. (c) Coefficient of fluctuation of energy, and (d) Maximum angular acceleration of the flywheel. (10 Marks)

Q4. (a) Calculate the minimum and maximum transmission angles for a four link mechanism when (5 Marks)
a = 2.5 cm. b = 5.0 cm c = 5.0 cm d = 6.0 cm

(b) In a slider crank mechanism as shown in the figure below, value of force applied on slider (Link 4) is 3000 N. Determine the forces on various links. Also find out the driving torque T_2.



$AB = 10$ cm, $BC = 30$ cm

(5 Marks)

P.T.O.

Part-B

Q5. (a) The screw of a car lift has 150 mm diameter with square threads of 50 mm pitch and lead of 100 mm. Assuming 1000 N of effort is required to lift the car and coefficient of friction is 0.20. Compute torques required to raise the car and lowers the car. Also determine overall efficiency of the screw. (5 Marks)

(b) A V-belt of 6.0 cm^2 cross section has a groove angle of 40^0 and angle of lap equal to 150^0. the mass of belt per meter run is 1.2 Kg. The maximum allowable stress in the belt is 850 N/cm^2. Taking $\mu = 0.10$, calculate the horse power that can be transmitted at a belt speed of 30 m/sec. (5 Marks)

Q6. The total sleeve movement of a spring controlled Hartnell governor is 3 cm. The mass of rotating ball is 1.35 Kg each. At the mid-position of the sleeve, the sleeve arm (horizontal) is 6.25 long and ball arm has a length of 7.5 cm. At the mid-position of the sleeve, the radius of rotation for balls is 10 cm.

Due to malfunctioning of the spring, the equilibrium governor speed at the top most position of the sleeve is 420 RPM and corresponding to the lowest position of the sleeve speed is 435 RPM. Determine:

(i) Stiffness and Initial Compression of spring.

(ii) Required Initial compression of the spring to give an equilibrium speed at the topmost position which is 12 RPM more than that at the lowest position. Neglect the moment due to weight of the ball. (10 Marks)

Q7. (a) Describe Bevis-Gibson's flash light torsion dynamometer with help of neat sketch. (4 Marks)

(b) A band brake acts on the 3/4th of circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 225 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in the (i) anticlockwise direction, and (ii) clockwise direction. (6 Marks)

x-x-x