Roll No. | | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 09

B.Tech. (Marine Engg.) (2013 Batch) (Sem.–5)

MECHANICS OF MACHINES-I

Subject Code : BTMR-504

Paper ID : [72717]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q1 Answer briefly :

a) What is Coriolis component of acceleration? Give example.

b) What do you mean by inversion of mechanism? Write two inversions of four bar chain.

c) Write Freudenstein equation.

d) What is kinematic synthesis?

e) What is the function of cam?

f) Classify different types of followers.

g) What is interference in gears?

h) State law of gearing.

i) What is the function of governor?

j) Explain the effect of gyroscopic couple on aeroplane taking left turn when viewed from rear.

SECTION-B

Q2 In a quick-return motion mechanism of crank and slotted lever type, the ratio of maximum velocities is 2. If the length of stroke is 25 cm, find :

a) The length of the slotted lever

b) The ratio of times of cutting and return strokes

c) The maximum cutting velocity per second if the crank rotates at 30 *r.p.m.*

Q3 Synthesize a four-bar linkage using Freudenstein's equation to generate the function $y = x^{1.5}$ for the interval $1 \leq x \leq 4$. The input crank is to start from $\theta_2 = 30°$ and is to have a range of 90°. Take three accuracy points. Take output crank angle from 0 to 90°

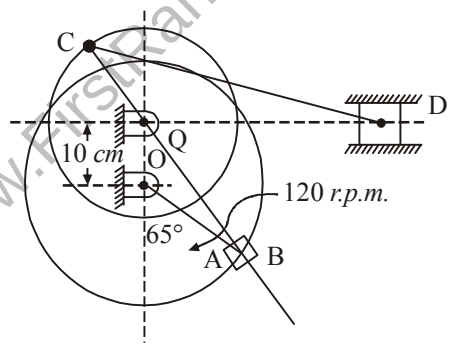
Q4 A cam with convex flanks operating a flat faced follower has base circle diameter of 7.5 cm and nose radius of 1 cm. The lift of the follower is 1.9 cm. The cam is symmetrical about a line drawn through the centre of nose and centre of cam shaft. The total angle of action is 120°. Determine maximum velocity, acceleration and retardation of the follower when the cam shaft rotates at 600 *r.p.m*.

Q5 Find the minimum number of teeth on the pinion to avoid interferences when the addendum for stub teeth is 0.84 module and the pressure angle $\Phi = \cos^{-1} 0.95$, if (a) the gear ratio is 3 to 1 and (b) the pinion meshes with a rack.

Q6 The 225 kg rotor for a turbojet engine has a radius of gyration of 250 mm and rotates counter clockwise at 18,000 *r.p.m.* when viewed from the front of the airplane. If the airplane is travelling at 1000 km/hr and making a turn to left of 3 km radius, compute the Gyroscopic moment M which the bearing must support.

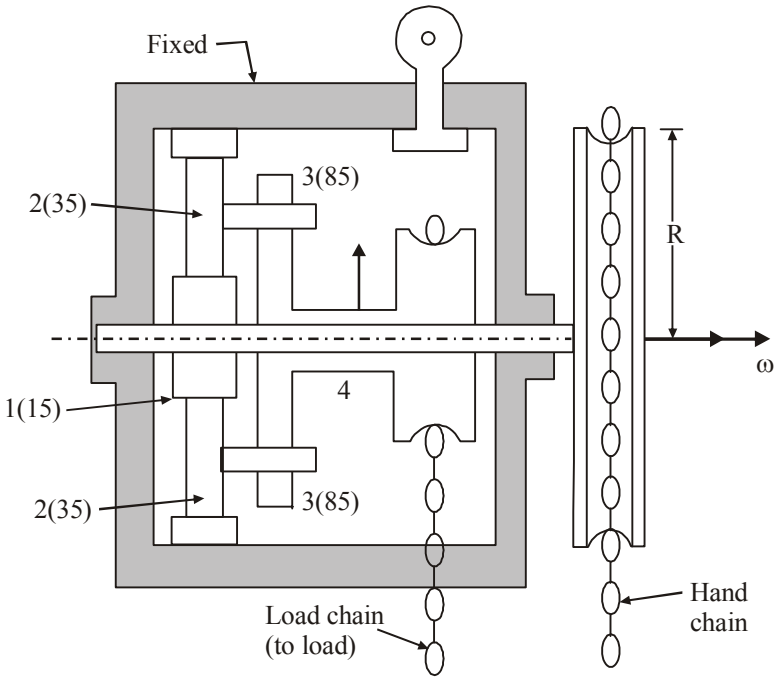
SECTION-C

Q7 Figure below shows the mechanism of Whitworth Quick Return Motion. Determine the velocity and acceleration of slider D.



CD = 50 cm, QB = 26 cm, CQ = 15 cm
CQB = 41 cm, OA = 20 cm, OQ = 10 cm

Q8 The Figure below of an epicyclic hoist is shown. The carrier 4 is integrally attached to sprocket wheel which carries the load chain. The sun gear, i.e., gear 1 is keyed to the sprocket wheel which carries the hand chain. The arm 4 is not connected to the shaft carrying the hand chain sprocket. The no. of teeth on the wheels are given in brackets. Gear 3 is an internal gear fixed inside the casing. Find the velocity ratio ω_1 / ω_4 where ω_1 is the angular velocity of the sprocket carrying the hand chain and ω_4 is the angular velocity of the sprocket carrying the load chain.



Q9 A governor of the Hartnell type has equal balls of mass 3 kg, set initially at a radius of 200 mm. The arms of the bell crank lever are 110 mm vertically and 150 mm horizontally. Find

a) The initial compressive force on the spring, if the speed for an initial ball radius of 200 mm is 240 r.p.m.; and

b) The stiffness of the spring required to permit a sleeve movement of 4 mm on a fluctuation of 7.5 percent in the engine speed.