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B. Tech 5th Semester Examination

Kinematics of m/c (O.S.)

ME-5001

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five question, selecting one question each from Section A, B, C & D. Section E is compulsory.

SECTION - A

1. (a) Enumerate the inversions of a double slider-crank chain. Give examples.
(b) The crank and connecting rod of an engine are 0.5m and 2 m long respectively. The crank makes 180 r.p.m in the clockwise direction. When it has turned 45° from the inner dead center position, determine (i) velocity of the piston (ii) angular velocity of connecting rod, (iii) velocity of point E on the connecting rod 1.5 m from the gudgeon pin, (iv) velocity of rubbing at the pins inserted at the joint made up of crank and connecting rod when the diameter is 60 mm. **(5+10=15)**
2. (a) Prove that the peaucellier mechanism generates a straight-line motion.
(b) In a Davis steering gear the distance between the pivots of the front axle is 90 cm and the wheelbase is 220 cm. When the vehicle is moving along a straight path, find the inclination of the track arms to the longitudinal axis of the vehicle. **(10+5=15)**

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SECTION - B

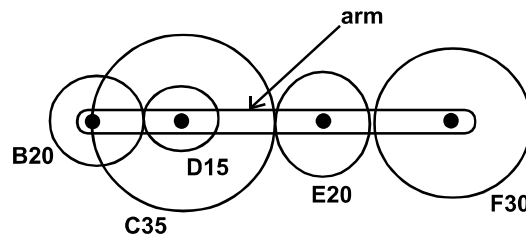
3. Draw the cam profile for following conditions:

Follower type = Knife edged, in-line; lift = 50mm; base circle radius = 50mm; out stroke with SHM, for 60° cam rotation; dwell for 45° cam rotation; return stroke with SHM, for 90° cam rotation; dwell for the remaining period. Determine max. velocity and acceleration during out stroke and return stroke if the cam rotates at 1000 rpm in clockwise direction. **(15)**

4. Derive an expression for displacement, velocity and acceleration of a tangent cam with roller follower, when roller is in contact with flank. **(15)**

SECTION - C

5. (a) Derive an expression for minimum number of teeth required on pinion to avoid interference in involutes gear teeth when it meshes with wheel.
- (b) A pair of spur gears has 16 and 18 teeth, a module of 13mm, addendum of 13mm, and pressure angle of 14.5° . Show that the gears have interference. Determine the amount by which the addendum must be reduced to eliminate the interference. **(7+8=15)**
6. (a) Prove that velocity of sliding is proportional to the distance of the point of contact from the pitch point.
- (b) The fig. shows an Epicyclic gear train. Wheel E is fixed and wheels C and D are integrally cast and mounted on the same pin. If arm A makes one revolution per sec (Counter clockwise) determine the speed and direction of rotation of the wheels B and F. Number of teeth on respective gears is shown in figure. **(7+8=15)**



SECTION - D

7. A four bar mechanism is to be designed by using (three precision points, to generate the function $y=x^{1.5}$ for range $1 \leq x \leq 4$. Assuming 30° starting position and 120° finishing position for the input link and 90° starting position and 180° finishing position for the output link, find the values of x , y , θ and ϕ corresponding to the three precision points. (15)
8. (a) Explain in detail the graphical Synthesis of slider crank mechanism for which three positions of the crank and corresponding three positions of the slider is known.
- (b) Explain mechanism for position guidance. (10+5=15)

SECTION - E

9. (a) Explain the different types of joints in a chain.
- (b) How decision is made whether the given combination of links is locked chain, kinematic chain or an unconstrained chain?
- (c) State difference between lower pair and higher pair? Give two examples for each.
- (d) How will you classify the followers on the basis of location of the axis of the follower and the shape of that part which is in contact with the cam? Give examples.

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- (e) With reference to different factors explain how the dwell period in cam mechanism is decided?
- (f) Why roller follower is preferred to that of knife edge follower?
- (g) Explain what interference is and how it is prevented?
- (h) Name the four important systems of gear teeth that are commonly used. Also give their field of applications.
- (i) Explain the working principle of differential gears. What will happen if differential gear is absent in automobile sector?
- (j) What is difference between pole and relative pole? Explain.
(4×10=40)