R13

Code No: 114CZ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, May - 2016
KINEMATICS OF MACHINES
(Common to ME, MCT, MSNT)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.
Illustrate your answers with NEAT sketches wherever necessary.

PART - A **(25 Marks)**

1.a) Distinguish between a machine and structure. [2]
b) What is Gruebler's Criterion, and how is it obtained? [3]
c) Distinguish between centrode and axode. [2]
d) State and explain the Three centers in line theorem. [3]
e) What are the advantages of Peaucellier mechanism over Hart mechanism? [2]
f) Draw the sketch of a Double Hooke's joint, and explain its main advantage over Single Hooke's joint. [3]
g) Name and explain any two types of followers used with cams. [2]
h) Write the expressions for maximum velocity and maximum acceleration during the outward stroke of a follower moving with SHM, in terms of Angular velocity of the cam. [3]
i) State and explain the law of gearing. [2]
j) Explain the principle of working of an Epicyclic gear train. [3]

PART - B **(50 Marks)**

2.a) A Whitworth quick- return motion mechanism has a length of stroke of 150 mm. The driving crank is 40 mm long, and the ratio of time of cutting stroke to that of return stroke is 2. Find the length of the fixed link and the angles of rotation of the crank corresponding to the cutting stroke and return strokes.
b) Explain the terms: Mechanical Advantage, Kutzback's Criterion and Structure. [5+5]

OR

3.a) Describe, with a neat sketch, the working of an Elliptical trammels as an inversion of the double slider crank chain. Prove that the path traced by a link of the mechanism is an ellipse.
b) Explain the terms: Successfully constrained motion, Flexible link. [6+4]

4. The dimensions of Atkinson-cycle engine mechanism is shown in Figure 1. OA = 12 cm; QB = 16 cm; AB = 30 cm; AC = 32 cm; BC = 5 cm; CP = 36 cm; If the crank OA makes 143.5 rpm *clockwise*, determine for the given configuration, the velocity of piston P, and the angular velocities of the links ABC and CP. Solve by the Relative Velocity Method. [10]

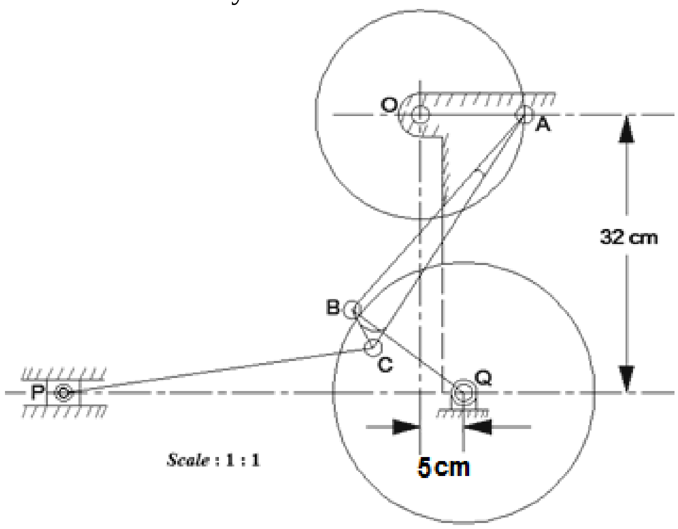

Figure: 1

OR

5. Draw the acceleration diagram for the shaper mechanism shown in Figure 2. OB = 150 mm, CB = 225 mm, OC = 150 mm. Find the coriolis acceleration of the slider B. [10]

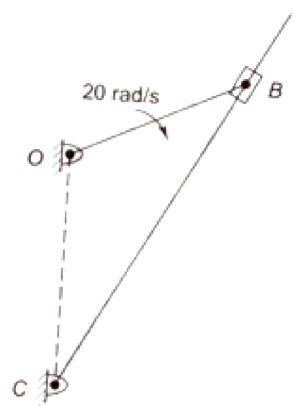

Figure: 2

6.a) A circle, with AD as diameter, has a point B on its circumference. There is a point C on AB produced such that if B turns about A, the product AB × AC remains constant. Prove that the point C moves in a straight line perpendicular to AB produced.

b) Prove that the Scott-Russel mechanism is an exact straight line mechanism. [5+5]

OR

7. A Hooke's joint connects two shafts which are having 160^0 as the included angle. The driving shaft rotates uniformly at 1500 rpm. Find the maximum angular acceleration of the driven shaft, and the maximum torque required if the driven shaft carries a flywheel of mass 12 kg and 100 mm radius of gyration. [10]

8. A cam rotating clockwise at a uniform speed of 300 rpm is required to give a knife edge follower the motion defined below:
a) Follower to move outward through a distance of 2.5 cm during 120^0 of cam rotation
b) Follower to dwell for 60^0 of cam rotation
c) Follower to return to its initial position during 90^0 of cam rotation.
d) Follower to dwell for the remaining 30^0 of cam rotation.
The minimum radius of cam = 5 cm. The line of stroke of the follower is offset 15 cm from the axis of cam. Displacement of the follower takes place with uniform velocity during the outward stroke and with SHM during the return stroke. Draw the profile of the cam, and determine the maximum acceleration during both the outward and inward strokes. [10]

OR

9. A symmetric tangent cam operates a roller follower. Least radius of the cam = 30 mm; Roller radius = 15 mm ; Angle of ascent = 75^0; Total lift = 15 mm; Speed of camshaft = 600 rpm; Determine the principal dimensions of the cam. [10]

10.a) How do you find the efficiency of worm gears? Derive the expression.
b) A pinion having 10 teeth of involute form, 20^0 pressure angle, and 6 mm module drives a gear having 40 teeth of addendum equal to one module. Find the addendum of pitch circle radii of the two gears, and the arc of contact. [4+6]

OR

11. In a sun and planet gear train, the sun wheel having 60 teeth is fixed to the frame. Determine the numbers of teeth on the planet and annulus wheels, if the annulus rotates at 130 rpm, and the arm rotates at 100 rpm, both in the same direction.[10]

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