U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 22AS3PCTOM **Max Marks: 100**
Course: Theory of Mechanisms **Date: 27.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Draw the kinematic diagram and determine the degree of freedom for the landing gear of an aircraft as shown in the Fig.-1a. **8**

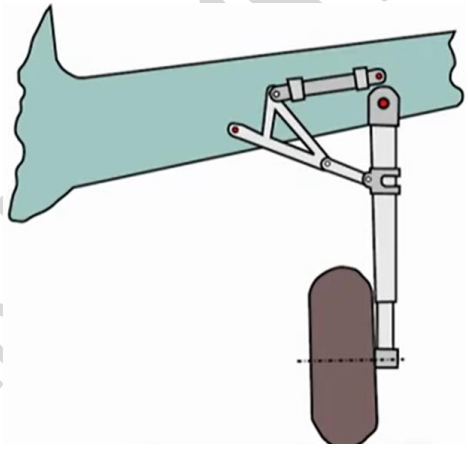

Fig. – 1a

b) Explain neatly the various straight-line motion mechanisms by giving their applications. **6**

c) Five binary links of length 5 cm, 8cm, 15 cm, 19 cm and 28 cm are available for constructing a crank-rocker mechanism. Select four links required for the construction of this mechanism. Draw a rough sketch of the mechanism and clearly show the fixed link, crank, and rocker. **6**

UNIT - II

2 a) Obtain the neat kinematic inversion sketches of the slider crank chain by fixing its different links and giving their applications. **9**

b) Explain the Pantograph mechanism with a neat sketch and give its applications. **5**

c) The length of the fixed link of the crank and slotted lever mechanism is 250 mm and that of the crank is 100 mm. Determine the i) inclination of the slotted lever with the vertical in the extreme position, ii) Length of the stroke, if the length of the slotted lever is 450 mm and the line of the stroke passes through the extreme position of the free end of the lever. **6**

UNIT - III

3 a) State and prove Kennedy's theorem. **6**

b) The mechanism of a wrapping machine, as shown in Fig.3b, has the following dimensions: O_1A = 100 mm; AC = 700 mm; BC = 200 mm; O_3C = 200 mm; O_2E = 400 mm; O_2D = 200 mm and BD = 150 mm. The crank O_1A rotates at a uniform speed of 100 rad/s. Find the velocity of point E of the bell crank lever. **14**

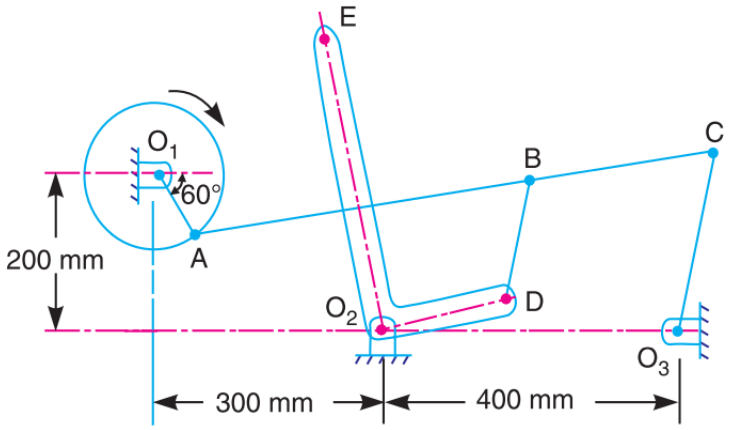

Fig. – 3b

UNIT - IV

4 a) Explain the radial and tangential acceleration of a link. **6**

b) A double slider crank mechanism is shown below Fig. 4b. The crank OA rotates at a constant angular velocity of 10 rad/s clockwise. The links OA, AB and AC are 100 mm, 200 mm and 200 mm long respectively and angle AOC =110°. By drawing the velocity and acceleration polygon, determine the velocity and acceleration of each slider and the angular acceleration of each connecting rod. **14**

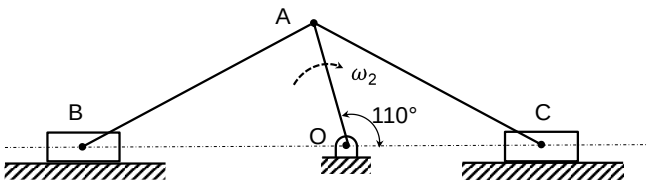

Fig. – 4b

OR

5 a) Explain the velocity and acceleration curves of a roller coaster on a bumpy track with neat sketch. **6**

b) In the mechanism shown in below Fig.5b, crank 2 rotates at 3000 rpm. OA = 50 mm, AB =175 mm, AC = 75 mm, BC = 125 mm. Find the acceleration of point C in magnitude and direction sense. Find the angular acceleration of link 3. **14**

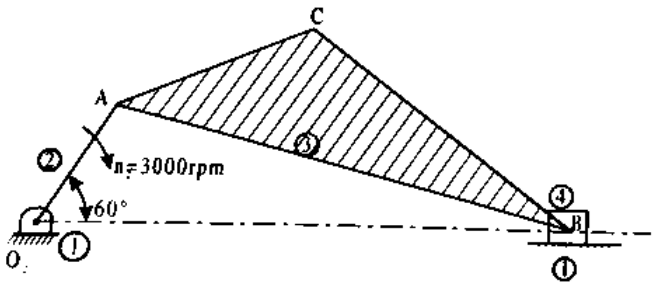

Fig – 5b

UNIT - V

6 a) Derive the expression for the Coriolis acceleration of a moving point relative to a fixed body. **12**

b) A link AR is rotating about point A as shown in Fig – 6b. At a particular instant when with the x-axis, the angular velocity of the link is *2 rad/s* ccw and angular acceleration is *5 rad^2/s* as shown in the figure. A slider P is sliding among the rod radially outwards and at that instant, the distance of the slider from point A is *2m* (i.e. distance AP=*2 m*). The corresponding point on the rod is Q. The velocity and acceleration of point P with respect to Q are *3 m/s* and *4 m/s^2* both radially outwards. Find the acceleration of: (i) Q relative A, (ii) P relative Q, iii) P relative A, **08**

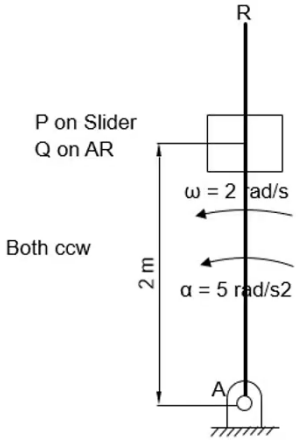

Fig – 6b

OR

7 a) In the crank and slotted lever type quick return motion mechanism shown in Fig.-7a, the crank AB rotates at 120 rpm (CW). Determine (a) velocity of ram at D, (b) magnitude of Coriolis acceleration component, and (c) acceleration of ram at D. AB = 200 mm, OC =800 mm, CD =600 mm and OA =300 mm. **20**

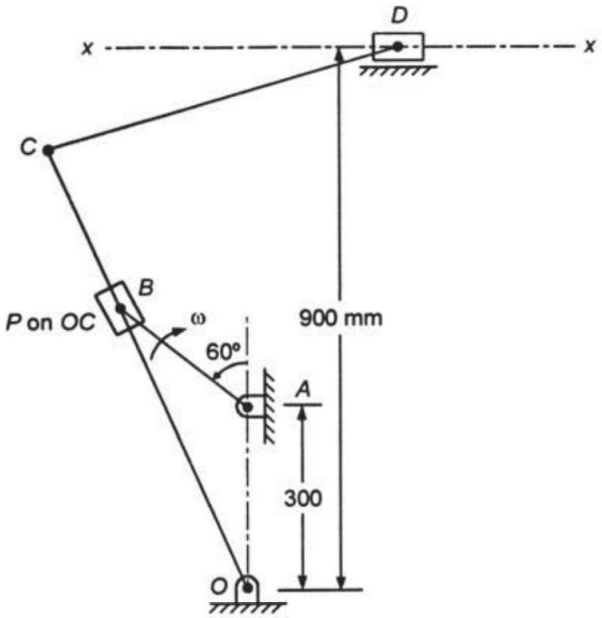

Fig – 7a

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