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Name of Examination : **Summer 2021** - (Preview)

Course Code & Course Name : **ME251U - Theory of Machine-I**

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Maximum Marks : **60**

Duration : **3 Hrs**

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Answer Key Submission Type: No marking scheme and solution

Instructions:

1. All questions are compulsory.
2. Illustrate your answer with suitable figures/sketches wherever necessary.
3. Assume suitable additional data; if required.
4. Use of logarithmic table, drawing instruments and non programmable calculators is allowed.
5. Figures to the right indicate full marks.

01) Solve any TWO sub questions.

- a) Differentiate between: (i) Lower and Higher pair (ii) Turning and rolling pairs (iii) Mechanism and Machine [06]
- b) Define kinematic inversion. Explain the inversion of single slider crank chain. [06]
- c) What is the degree of freedom of a mechanism? How is it determined [06]

02) Solve any TWO sub questions.

- a) Explain the terms: function Generation, path Generation and Motion Generation [06]
- b) What is the pole of a coupler link of a four bar mechanism? State its properties? What is the relative pole? [06]
- c) What is Freudenstein's equation? How is it helpful in designing a four bar mechanism when three position of input and output link are known? [06]

03) Solve (Compulsory)

- a) Draw the configuration(space) diagram for an engine mechanism with the following dimensions: Crank OA=200mm, O is the fixed pivot, connecting rod AB=600mm, At point B the slider is connected which slides along the horizontal path, $\angle BOA=60^\circ$ (CCW), distance of centre of mass from crank end, AD=200mm (on the link AB). Find the (i) velocity of D and angular velocity of AB (ii) Acceleration of D and angular acceleration of AB (iii) point on the connecting rod which has zero acceleration at this instant. [10]
- b) Define: (i) Kinematic synthesis (ii) kinematic analysis [02]

04) Solve any TWO sub questions.

- a) In a Screw jack, the diameter of the threaded screw is 40mm and the pitch is 8mm. The load is 20kN and it doesn't rotate with the screw but is carried on a Swivel head having a bearing diameter of 70mm. The coefficient of friction between a Swivel head and a spindle is 0.08 and between screw and nut is 0.1. Determine the total torque required to raise the load and the efficiency? [06]
- b) What is clutch? Explain the working of a multi-plate clutch with the help of a neat sketch [06]
- c) Define "Initial Tension" and "Creep" in a belt drive? What is the effect of Centrifugal tension on the power transmitted? [06]

05) Solve (Compulsory)

- a) Draw the configuration diagram of a Four-link mechanism with the following dimensions: AD is the fixed link and parallel to the ground, AD=500mm, $\angle DAB=120^\circ$ (CCW), Crank AB=400mm, connecting rod BC=1000mm, DC(output link)=750mm, DE=350mm, Point E is on link DC is acted upon by a force $80\angle 150^\circ$ Newton. Determine the input torque T on the link AB for the static equilibrium of the mechanism for the given configuration. [10]
- b) Define (i) Applied forces (ii) Constraint forces [02]

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