

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

Autonomous Institute Affiliated to VTU

## September / October 2023 Supplementary Examinations

Programme: B.E.

Branch: Mechanical Engineering

Course Code: 19ME4DCKOM / 15ME4DCKOM

Course: Kinematics of Machines

Semester: IV

Duration: 3 hrs.

Max Marks: 100

Date: 21.09.2023

**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) Distinguish between Rigid link and Flexible link with an example. **06**
- b) What is Kutzbach's criterion for degree of freedom of plane mechanism? In what way Gruebler's criteria is different from it? Compute degree of freedom of two spur gear in contact. **07**
- c) With a neat sketch explain the working of an Oldham's coupling. Justify how it can be considered as an inversion of double slider crank chain. **07**

OR

- 2 a) Explain with a neat labeled sketch, the principle and working of Whitworth quick return motion mechanism. **08**
- b) Neatly sketch and explain the working of Peaucellier's mechanism. Also, prove that it traces a straight line. **08**
- c) Derive the expression for necessary condition of correct steering. **04**

### UNIT - II

- 3 In the toggle mechanism shown in Figure 1, the crank OA rotates at 210 rpm counter-clockwise increasing at the rate of  $60 \text{ rad/s}^2$ . For the given configuration, determine: (i) Velocity of the slider D and the angular velocity of the link BD, and (ii) Acceleration of slider D and the angular acceleration of the link BD. **20**

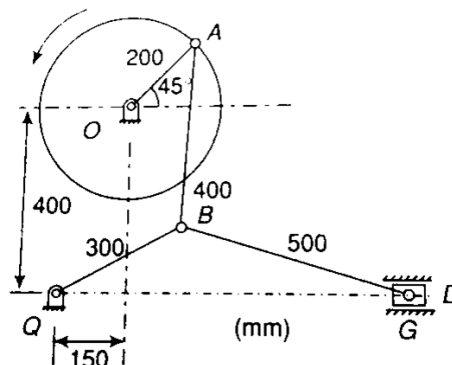


Figure 1

**Important Note:** Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

OR

- 4 Figure 2 shows the link mechanism of a quick-return mechanism of the slotted lever type, the various dimensions of which are,  $OA=400\text{mm}$ ,  $OP=200\text{mm}$ ,  $AR=700\text{mm}$ ,  $RS=300\text{mm}$ . For the configuration shown determine the acceleration of the cutting tool at S and the angular acceleration of the link RS. The crank OP rotates at 210 rpm. 20

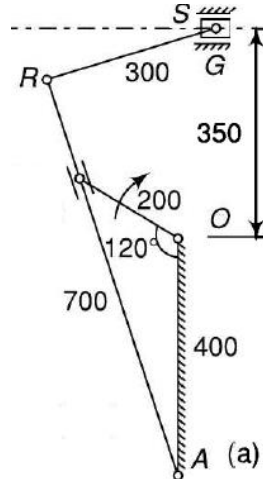


Figure 2

### UNIT - III

- 5 a) What is arc of contact? Derive relation for its magnitude. 07  
 b) With a neat sketch, describe the procedure for determining the velocities of links in a slider crank chain mechanism by using Klein's Construction method. 06  
 c) Two  $20^\circ$  involute spur gears have a module of 10mm. The addendum is equal to one module. The larger gear has 40 teeth while the pinion has 20 teeth. Will the gear interfere with the pinion? 07

### UNIT - IV

- 6 a) Write short notes on: i) Simple Gear Train & ii) Compound Gear Train. 06  
 b) Gear Train shown in Fig.3, in which gears D-E and F-G are compound gears. D gears with A and B; E gears with F; and G gears with C. The numbers of teeth on each gear are  $A=60$ ,  $B=120$ ,  $C=135$ ,  $D=30$ ,  $E=75$ ,  $F=30$ ,  $G=60$ . If the wheel A is fixed and the arm makes 20 revolutions clockwise, find the revolutions of B and C. 14

If the arm is applied a turning moment of 1kNm, determine the turning moment on the shaft supporting the wheel C.

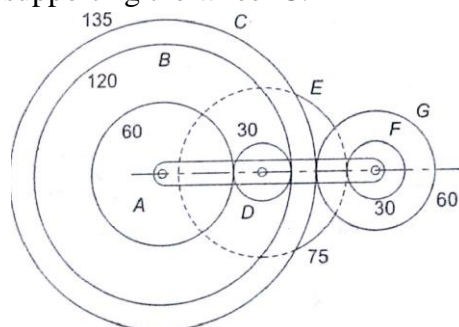


Figure 3

## UNIT - V

- 7      A knife edged follower is operated by a uniformly rotating cam. Draw the cam profile for following conditions: follower rises by 24mm with SHM in  $1/4^{\text{th}}$  rotation, dwells for  $1/8^{\text{th}}$  rotation and then raises again by 24mm with UARM in  $1/4^{\text{th}}$  rotation and dwells for  $1/16^{\text{th}}$  rotation before returning with SHM. Base circle radius= 30mm.Speed of cam=200rpm.Find the maximum velocity and acceleration during out stroke and return stroke. **20**

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SUPPLEMENTARY EXAMS 2023