

**JK Lakshmipat University Jaipur**  
**INSTITUTE OF ENGINEERING AND TECHNOLOGY**  
 End Term Examination, December 2022  
 Department of Mechanical Engineering  
 B.Tech (V Semester)

Roll No.....

Theory of Machines (ME1108)

Time: 3 hours

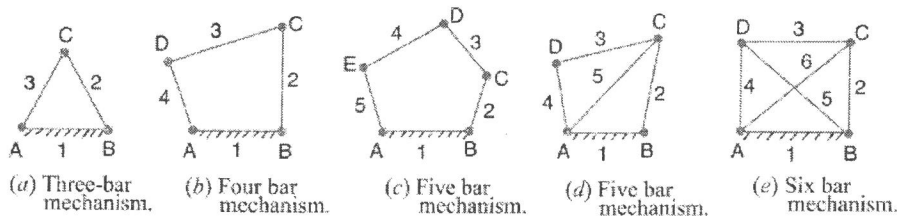
Max. Marks: 50

**Instructions to students:** All kinds of resources are allowed to use during examination, e.g., book, eBooks, notes, laptop, Wi-Fi etc.

Assume suitable data wherever required and mention it clearly.

Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

- Q.1 Using Kutzbach criterion, determine the degree of freedom of each planer mechanism and also identify determinant and indeterminate structures. 10 marks



CO1

Figure 1: Plane mechanisms

- Q.2 In a crank and slotted lever quick return motion mechanism, the distance between the fixed centres **O** and **C** is 200 mm. The driving crank **CP** is 75 mm long. The pin **Q** on the slotted lever, 360 mm from the fulcrum **O**, is connected by a link **QR** 100 mm long, to a pin **R** on the ram. The line of stroke of **R** is perpendicular to **OC** and intersects **OC** produced at a point 150 mm from **C**. Determine the ratio of times taken on the cutting and return strokes. 10 marks

CO2

- Q.3 A blower is driven by an electric motor though a belt drive. The motor runs at 750 r.p.m. For this power transmission, a flat belt of 8 mm thickness and 250 mm width is used. The diameter of the motor pulley is 350 mm and that of the blower pulley 1350 mm. The centre distance between these pulleys is 1350 mm and an open belt configuration is adopted. The pulleys are made out of cast iron. The frictional coefficient between the belt and pulley is 0.35 and the permissible stress for the belt material can be taken as 2.5 N/mm<sup>2</sup> with sufficient factor of safety. The mass of a belt is 2 kg per metre length. Find the maximum power transmitted without belt slipping in any one of the pulleys. 10 marks

CO3

Q.4 Two mating gears have 20 and 40 involute teeth of module 10 mm and  $20^\circ$  pressure angle. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum height for each gear wheel, length of the path of contact, arc of contact and contact ratio. 10 marks CO 4

Q.5 A disc cam rotating in a clockwise direction is used to move a reciprocating roller with simple harmonic motion in a radial path, as given below: 10 Marks CO 5

- (i) Outstroke with maximum displacement of 25 mm during  $120^\circ$  of cam rotation,
- (ii) Dwell for  $60^\circ$  of cam rotation,
- (iii) Return stroke with maximum displacement of 25 mm during  $90^\circ$  of cam rotation,
- (iv) Dwell during remaining  $90^\circ$  of cam rotation.

The line of reciprocation of follower passes through the camshaft axis. The maximum radius of cam is 20 mm. If the cam rotates at a uniform speed of 300 r.p.m. find the maximum velocity and acceleration during outstroke and return stroke. The roller diameter is 8 mm.