Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: THEORY OF MACHINES [MTE 2201]

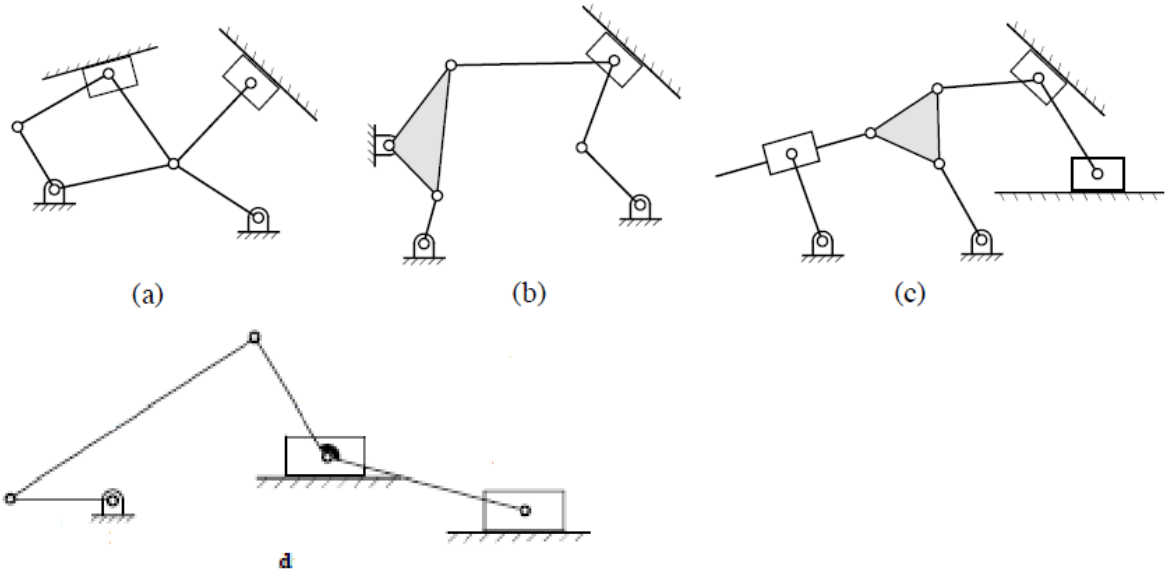
19th April, 2017

Time: 3 Hours **[REVISED CREDIT SYSTEM]** MAX. MARKS: 50

Instructions to Candidates:

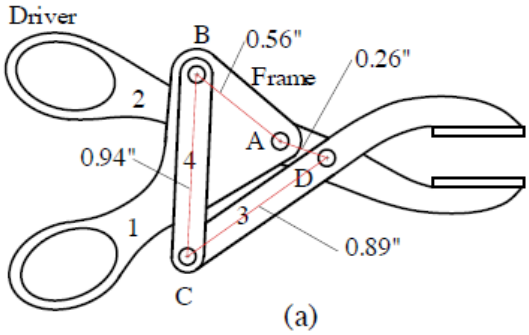
- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. Find the number of links, binary joints and calculate the degree of freedom of planar linkages shown in figures a, b, c and d. **(8)**
Note:- shaded regions are a plate and rectangular boxes are sliders.



1B. In a flat pivot bearing having a diameter of 200mm. Total axial load is 80kN and intensity of pressure is 300kN/m^2 and coefficient of friction as 0.02. Calculate the power loss considering uniform pressure theory and uniform wear theory in overcoming friction if the shaft rotates at 400 RPM. **(2)**

2A. In the figure 2.1 (a) and 2.1 (b) shown below, check for Grashof law and determine the Grashof type of each four bar linkage (A-B-C-D) in each mechanism. **(2)**



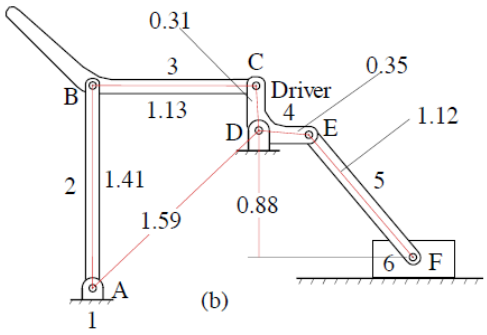


Figure 2.1 (a) and (b)

2B. What do you understand by radial acceleration and tangential acceleration of a link in a planar mechanism? **(Mathematical formulation is required)** **(3)**

2C. In the figure 2.2 given below, bar AB rotates with constant angular velocity 10 rad/s about A. Calculate velocity and acceleration of slider C and link BC by graphical method when θ = 53 degrees and length L = 50 mm. The vertical distance between A and C is 6 mm. **(5)**

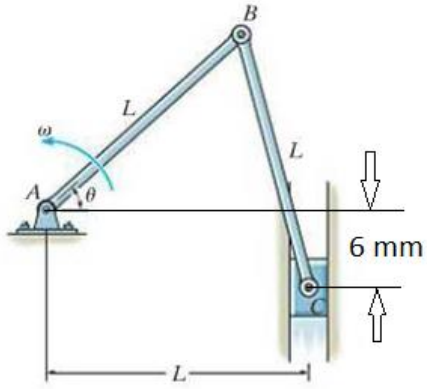


Figure 2.2

3A. A cam lifts the follower for 120^0 through 30 mm followed by a dwell period of 30^0 and then it descents down in 150^0 and rest is again dwell, the motion is parabolic. If cam rotates with 150 RPM, calculate maximum velocity and acceleration during descent. **(2)**

3B. Draw the profile of a cam having a knife edge follower having lift of 30 mm. Follower rises in SHM for 150^0 followed by 60^0 dwell period. The follower descents for next 100^0 with constant velocity. Speed of cam shaft is 120 RPM and cam has a least radius of 20mm. **(5)**

3C. In the figure 3.1 gear D and E are compounded and number of teeth on Gear C, D and E are 50, 20 and 35. If the sun gear rotates with 100 RPM and annular wheel G is fixed. Calculate speed of arm and number of teeth on annular assuming the module of every gear as same. **(3)**

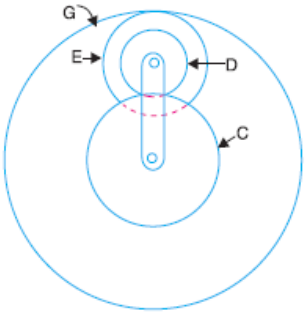


Figure 3.1

4A. Four masses A, B, C, D in series are carried by a rotating shaft at radii 80mm, 100mm, 160mm and 120mm are dynamically balanced. Masses B, C and D are 8kg, 4kg and 3kg respectively. Determine the mass A and relative angular positions of the A, C and D masses w.r.t B if the planes are spaced 500mm apart.(Graphical method) **(4)**

4B. Two involute gears in a mesh have a module of 8 mm and pressure angle of 20^0. The larger has 57 teeth while the pinion has 23 teeth. If the addenda on pinion and gears wheels are equal to one module. Find the **(3)**

(i) Arc of contact.
(ii) Contact ratio.
(iii) Angle of action for pinion and wheel

4C. In a gear train shown in figure 4.1, input and output shafts mounted with gear 1 and 4. A counter shaft carrying two gears 2 and 3. The ratio of speed of input to output shaft is 12 and they are collinear as shown in the figure 4.1 below. It was decided to use a speed ratio of gear 1 to 2 equal to 4 with 3mm module and the module for 3-4 gear is 4 mm. The number of Teeth on gear 1 and 3 are $Z_1 = 16$ and $Z_3 = 15$. **(3)**

(i). Calculate Number of teeth on gear 2 and 4.
(ii). Determine the center distance between gear 3 and 4.

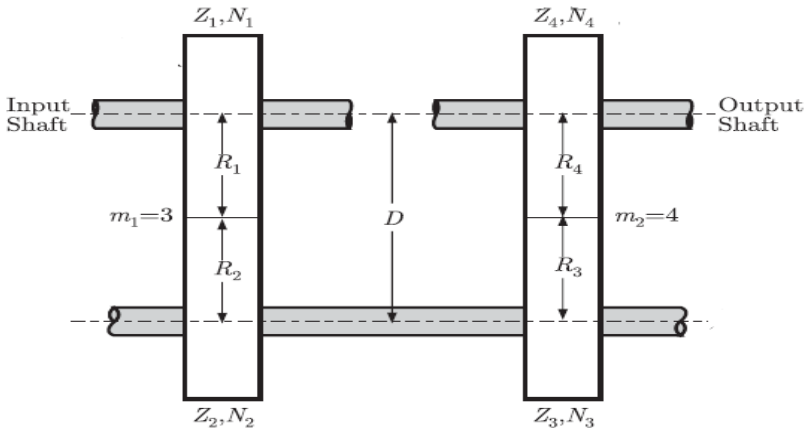


Figure 4.1

5A. Define (i) dynamic unbalancing, (ii) quasi static unbalancing. What conditions needs to be fulfilled for a multi mass at multi plane system to be in dynamic balancing? **(3)**

5B. In crank and slotted lever quick return mechanism, the driving crank length is 75mm, length of the fixed link is 200mm and length of slotted lever is 500mm, determine **(2)**

(a) Stroke length (b) cutting angle (c) return angle and (d) calculate cutting ratio.

5C. Derive an expression for minimum number of teeth on pinion for given gear ratio G, pressure angle φ and addendum coefficient a_p. **(5)**