

M.E. / M.TECH. DEGREE EXAMINATIONS, DEC 2020 (Held during April, 2021)

First Semester

MS18102 – Concepts in Mechanisms and Machines

(Mechatronics Engineering)

(Regulation 2018)

Time: Three Hours

Maximum : 80 Marks

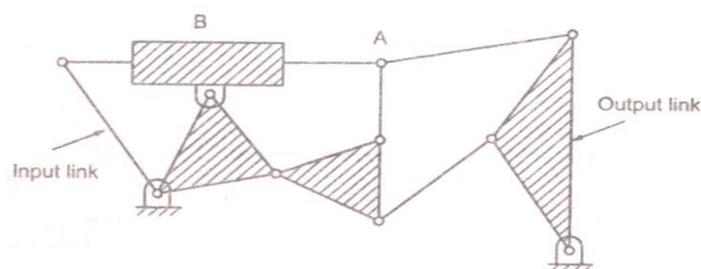
Answer ALL questions

PART A - (8 X 2 = 16 Marks)

1. Which one of the following mechanisms is an inversion of double slider-crank chain?
a) Elliptic trammels b) Beam engine c) Oscillating cylinder engine d) Coupling rod of a locomotive
2. In its simplest form, a cam mechanism consists of following number of links
a) 1 b) 2 c) 3 d) 4
3. The maximum frictional force, which comes into play, when a body just begins to slide over the surface of the other body, is known as
a) static friction b) dynamic friction c) limiting friction d) coefficient of friction
4. For a power screw having square threads with lead angle of 45° and coefficient of friction of 0.15 between screw and nut, the efficiency of the power screw, neglecting collar friction, is given by
a) 74% b) 64% c) 54% d) 44%
5. Which one of the following is used to convert a rotational motion into a translational motion?
a) bevel gears b) double helical gears c) worm gears d) rack and pinion gears
6. Two parallel shafts whose axes are separated by a distance of 75 mm are to be connected a spur gear set so that the output shaft rotates at 50% of the speed of the input shaft which of the following could be the possible pitch circle diameters of the gears.
a) 25mm to 50 mm b) 30 mm to 60 mm c) 50 mm to 100 mm d) 60 mm to 120 mm
7. Discuss about the factors that affect the critical speed of a shaft.
8. Define the term vibration isolation

PART B - (4 X16 = 64 Marks)

- 9 (a) (i) State and brief the Kutzbach criterion for planar mechanism and using this criterion, determine the arrangement shown in figure whether it is a structure or constrained motion or an unconstrained motion. (6)



- (ii) In a crank and slotted lever quick return mechanism, the distance between the fixed centres is 240 mm and the length of the driving crank is 120 mm. Find the inclination of the slotted bar with the vertical in the extreme position and the time ratio of cutting stroke to the return stroke. (10)

(OR)

- (b) (i) Define the kinematic inversion and neatly sketch an elliptical trammel and prove that all the points on the revolving link of the elliptical trammel will trace the ellipse only. **(8)**
- (ii) Prove that Peaucellier exact straight line mechanism will trace the exact straight line with a neat sketch. **(8)**
10. (a) A shaft has a number of collars integral with it. The external diameter of the collars is 400 mm and the shaft diameter is 250 mm. If the intensity of pressure is 0.35 N/mm^2 (uniform) and the coefficient of friction is 0.05, estimate 1. Power absorbed when the shaft runs at 105 rpm carrying a load of 150kN and 2. Number of collars required. **(16)**
- (OR)**
- (b) A leather belt 125 mm wide and 6 mm thick, transmits power from a pulley 750 mm diameter which runs at 500 rpm. The angle of lap is 150° and $\mu = 0.3$. If the mass of 1 m^3 of leather is 1 Mg and the stress in the belt is not to exceed 2.75 MPa. Find the maximum power that can be transmitted. **(16)**
11. (a) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and contact ratio. **(16)**
- (OR)**
- (b) The arm of an epicyclic gear train rotates at 100 rpm in the anticlock wise direction. The arm carries two wheels A and B having 36 and 45 teeth respectively. The wheel A is fixed and the arm rotates about the centre of wheel A. Find the speed of wheel B. What will be the speed of B, if the wheel A instead of being fixed, makes 200 rpm. **(16)**
12. (a) What kind of drive systems are preferred for CNC systems? Justify your statements with suitable sketch? **(16)**
- (OR)**
- (b) Three rotors A, B and C having moment of Inertia of 2000; 6000 and 3500 kg-m^2 respectively are carried on a uniform shaft of 0.35 m diameter. The length of the shaft between the rotors A and B is 6 m and between B and C is 32 m. Find the natural frequency of the torsional vibration. The modulus of rigidity for the shaft material is 80 GN/m^2 . **(16)**