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B.E/B.TECH (Full-time) End semester Examinations, April-May 2019

ME 8452 – MECHANICS OF MACHINES

Common to Manufacturing Engineering, Industrial Engineering, Materials Science
Engineering and Printing Technology

(Regulations 2012)

Time: 3 Hours

Answer All Questions

Max. Marks: 100

PART-A (10 x 2 = 20 Marks)

1. Determine the number of degrees of freedom of the mechanism shown in Fig. 1.
2. Differentiate between radial and cylindrical cams.
3. Define arc of contact.
4. Define train value.
5. What is meant by efficiency of a screw jack?
6. Classify mechanical brakes based on the direction of external force.
7. Define inertia force.
8. What do you mean by the term constraint forces?
9. What is unbalanced force in reciprocating engines?
10. What is natural frequency of a body?



Part-B (5 x 16 = 80 Marks)

11. For the mechanism shown in Fig. 11, determine the torque on the link AB for the static equilibrium of the mechanism.

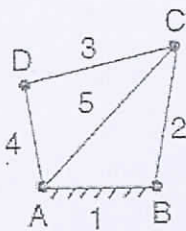


Fig. 1.

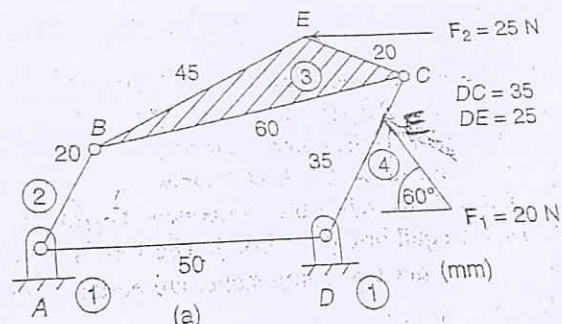


Fig 11.

12(a) In a slider crank mechanism, the lengths of the crank and the connecting rod are 200 mm and 800 mm respectively. Locate all the instantaneous centres of the mechanism for the position of the crank when it has turned 30° from the inner dead centre. Also find the velocity of the slider and the angular velocity of the connecting rod if the crank rotates at 40 rad/s.

[OR]

12(b) A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below :

1. To move outwards through 40 mm during 100° rotation of the cam ;
2. To dwell for next 80° ;
3. To return to its starting position during next 90° , and
4. To dwell for the rest period of a revolution i.e. 90° .

Draw the profile of the cam when the line of stroke of the follower passes through the centre of the cam shaft, and the displacement of the follower is to take place with uniform acceleration and uniform retardation. Determine the maximum velocity and acceleration of the follower when the cam shaft rotates at 900 rpm.

13(a) Two involute gear wheels having module 3 mm and pressure angle 20° mesh externally to give a velocity ratio of 3. The pinion rotates at 75 rpm and addendum is equal to one module. Determine the number of teeth on each wheel so that interference is just avoided, the length of path of contact and arc of contact, the number of pairs of teeth in contact and the maximum velocity of sliding between the teeth.

[OR]

13(b) An epicyclic train of gears is arranged as shown in Fig.13b. How many revolutions does the arm, to which the pinions B and C are attached, make :

1. when A makes one revolution clockwise and D makes half a revolution anticlockwise, and
2. when A makes one revolution clockwise and D is stationary ?

The number of teeth on the gears A and D are 40 and 90 respectively.

14(a) A belt drive is required to transmit 10 kW from a motor running at 600 rpm. The belt is 12 mm thick and has a mass density of 0.001 g/mm^3 . The safe stress in the belt is not to exceed 2.5 N/mm^2 . The diameter of the driving pulley is 250 mm, whereas the speed of the driven pulley



is 220 rpm. The two shafts are 1.25 m apart. The coefficient of friction is 0.25. Determine the width of the belt.

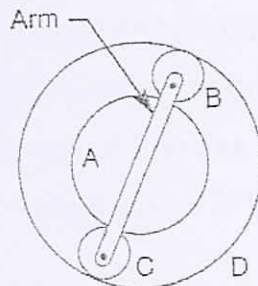


Fig 13b.

[OR]

14(b) A centrifugal clutch transmits 20 kW of power at 750 rpm. The engagement of the clutch commences at 70% of the running speed. The inside diameter of the drum is 200 mm and the distance of the centre of mass of each shoe is 40 mm from the contact surface. Determine the mass of each shoe, the net force exerted by each shoe on the drum surface and the power transmitted when the shoe is worn 2 mm and is not readjusted. Assume coefficient of friction to be 0.25 and the stiffness of the spring to be 150 kN/m.

15(a) Four masses 150 kg, 250 kg, 200 kg and 300 kg are rotating in the same plane at radii 0.25 m, 0.2 m, 0.3 m and 0.35 m respectively. Their angular location is 40° , 120° , and 250° from mass 150 kg, respectively measured in counter-clockwise direction,. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.25m.

[OR]

15(b) A mass of 10 kg is suspended from one end of a helical spring, the other end being fixed. The stiffness of the spring is 10 N/mm. The viscous damping causes the amplitude to decrease to one-tenth of the initial value in four complete oscillations. If a periodic force of $150 \cos 50 t$ N is applied at the mass in the vertical direction, find the amplitude of the forced vibrations. What is its value of resonance ?

ALL THE BEST

