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B.E / B.Tech DEGREE END SEMESTER EXAMINATIONS, APRIL/MAY2014

FIFTH SEMESTER

ME8452 MECHANICS OF MACHINES

(REGULATION 2012)

(Common to branches of Printing Technology, Manufacturing Engineering, Industrial Engineering, and Materials science & Engineering)

Time : 3 hr.

Max. Mark :100

Answer ALL Questions

Part A (10 x 2 = 20 Marks)

- 1 Enumerate the difference between a Machine and a Structure.
- 2 Define the term Kinematic Inversion
- 3 What do you understand the term 'interference' as applied to toothed gearing?
- 4 What is reverted gear train?
- 5 Diagrammatically represent the forces acting on a body when it slides either up or down on an inclined plane without considering the effect of friction.
- 6 What is the condition of maximum efficiency of a Screw jack?
- 7 Depict 'under-damped vibrations', 'over-damped vibrations' and 'critically damped vibrations' with the help of amplitude vs time plot.
- 8 Define the term swaying couple.
- 9 Distinguish between the unbalanced force caused due to rotating and reciprocating masses.
- 10 What type of motion is exhibited by a vibrating system when it is critically damped?

PART B (5 x 16 = 80 Marks)

- 11 A horizontal steam engine running 240 rpm has a bore of 300mm and stroke 600mm. The connecting rod 1.05m long and mass of reciprocating parts is 60kg. When the crank is 60° past its inner dead centre, the steam pressure on the cover

side of the piston is 1.125N/mm^2 , while that on the crank side is 0.125N/mm^2 . Neglecting the area of the piston rod, determine:

- (i) force in the piston rod
- (ii) pressure on guide bars
- (iii) thrust in the connecting rod
- (iv) tangential force on the crank pin
- (v) thrust on crank shaft bearing, and
- (vi) turning moment on the crank shaft

(16)

12a Draw the cam profile to the following specification:

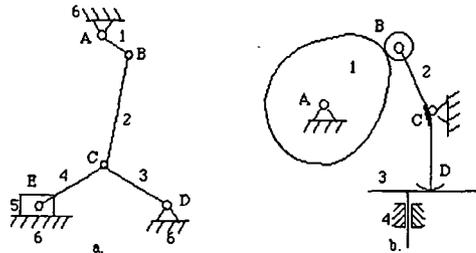
- (a) Follower to move outwards during the first 60° rotation of the cam ;
- (b) Follower to dwell during the next 20° of cam rotation.
- (c) Follower to return to its initial position during next 60° rotation of the cam ;

The lift is 37.5 mm and the least radius of the cam is 40 mm. The follower is provided with a roller of radius 20 mm and its line of stroke passes through the axis of the cam. It is required to give equal uniform acceleration and retardation during outstroke and return stroke.

(16)

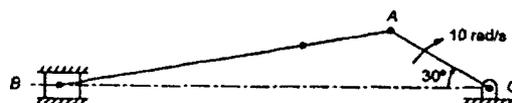
[OR]

12b (i) Calculate the degrees of freedom for the following :



(4)

- (ii) Compute the acceleration of slider B for the Figure shown below. The lengths links are $OA=200\text{mm}$, $AB=600\text{mm}$ and $\angle AOB=30^\circ$. The crank rotates at constant angular velocity of 10 rad/s in clock wise direction.



(12)

- 13a Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25 ? (16)

[OR]

- 13b (i) A single plate clutch, with both sides effective, has outer and inner diameters 300 mm and 200 mm respectively. The maximum axial thrust is 3142N. If the coefficient of friction is 0.3, determine the power transmitted by a clutch at a speed 2500 r.p.m. Use uniform wear theory. (8)
- (ii) The pitch of 50 mm mean diameter threaded screw of a screw jack is 12.5 mm. The coefficient of friction between the screw and the nut is 0.13. Determine the torque required on the screw to raise a load of 25 kN, assuming the load to rotate with the screw. Determine the ratio of the torque required to raise the load to the torque required to lower the load and also the efficiency of the machine. (8)

- 14a A,B,C and D are four masses carried by a rotating shaft at radii 100mm, 150mm,150mm and 200mm respectively. The planes in which the masses rotate are spaced at 500 mm apart and magnitude of the masses B,C and D are 9Kg,5kg, and 4kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft be in complete balance. (16)

[OR]

- 14b Mass of a single degree damped vibrations system measures 6kg and makes 25 free oscillations in 11 seconds. The amplitude of vibration reduces by 30% of its initial value after 5 oscillations. Determine
- The stiffness of the spring
 - Logarithmic decrement
 - Damping factor
 - Critical damping coefficient and
 - Actual damping coefficient.
- (16)

- 15a 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 the contact ratio. (16)

[OR]

- 15b In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B ? (16)