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B.E / B.Tech (F.T.) DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2013

Common to Industrial Engineering. Printing Technology and Manufacturing Engineering

THIRD SEMESTER

ME 550/ME9211 MECHANICS OF MACHINES

(REGULATION 2004 /2008)

Time : 3 hr. Max. Mark :100

Answer ALL Questions

Part A (10 x 2 = 20 Marks)

1 What is free body diagram? How is it helpful in finding the various forces acting on members of a mechanism?

2 State and explain D'Alembert's principle.

3 Give reasons why it is very essential that all the rotating and reciprocating parts should be completely balanced as far as possible.

4 What is meant by dynamic balancing and state the necessary condition to achieve them.

5 Draw neat sketches of the under damping, critical damping and over damping with regard to free vibration.

6 Define rubbing velocity at a pin joint. What will be the rubbing velocity at pin joint when the two links move in the same and opposite directions?

7 Explain the terms : (i) Module, & (ii) Pressure angle.

8 Explain briefly the differences between simple, compound, and epicyclic gear trains. What are the special advantages of epicyclic gear trains ?

9 What is centrifugal tension in a belt ? How does it affect the power transmitted?

10 Explain the following :
(i) Limiting friction, and (ii) Angle of friction.

PART B (5 x 16 = 80 Marks)

11 A connecting rod 220 mm long between centres, has a mass of 2 kg and moment of inertia of $2x10^4$ kg mm^2 about its centre of gravity. Centre of gravity is located at a

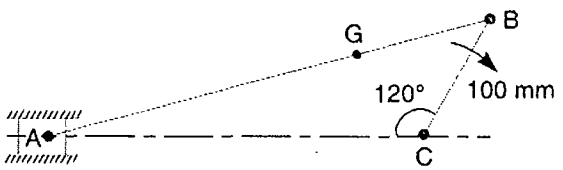
distance of 150 mm from the small end centre. Determine the dynamically equivalent two mass system when one mass is located at the small end centre.
If the connecting rod is replaced by two masses located at the two centres, find the correction couple that must be applied for complete dynamical equivalence of the system, when the angular acceleration of the connecting rod is 20000rad/s^2 clockwise. (16)

12a A rotating shaft carries four unbalanced mass 18kg, 14kg, 16kg and 12kg at radii 5cm, 6cm, 7cm and 6 cm respectively. The 2nd , 3rd and 4th masses revolve in planes 8 cm, 16 cm, and 28 cm respectively measured from the plane of the first mass and are angularly located at 60°, 135° and 270° respectively measured anticlockwise from the first mass looking from this mass end of the shaft. The shaft is dynamically balanced by two masses, both located at 5 cm radii and revolving in planes mid way between those of 1st and 2nd masses and midway between those of 3rd and 4th masses. Determine graphically or otherwise, the magnitude of the masses and their respective angular positions. (16)

[OR]

12b Find the logarithmic decrement and the ratio of any two consecutive amplitude of a vibrating system, which consists of a mass of 3.5 kg, a spring of stiffness 2.5 N/mm and a damper of damping coefficient 0.018 N/mm/S. (16)

13a An engine mechanism is shown in Fig. below. The crank CB = 100 mm and the connecting rod BA = 300 mm with centre of gravity G, 100 mm from B. In the position shown, the crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s^2. Find:1. Velocity of G and angular velocity of AB, and 2. Acceleration of G and angular acceleration of AB.



(16)

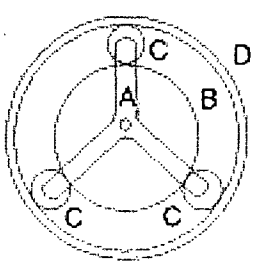
[OR]

13b A cam drives a flat reciprocating follower in the following manner :
During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam. (16)

14a A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact. (16)

[OR]

14b In an epicyclic gear of the 'sun and planet' type shown in Fig. below, the pitch circle diameter of the internally toothed ring is to be 224 mm and the module 4 mm. When the ring D is stationary, the spider A, which carries three planet wheels C of equal size, is to make one revolution in the same sense as the sun wheel B for every five revolutions of the driving spindle carrying the sun wheel B. Determine suitable numbers of teeth for all the wheels.



(16)

15a A conical pivot bearing supports a vertical shaft of 200 mm diameter. It is subjected to a load of 30 kN. The angle of the cone is 120° and the coefficient of friction is 0.025. Find the power lost in friction when the speed is 140 r.p.m., assuming 1. Uniform pressure; and 2. uniform wear. (16)

[OR]

15b 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)