6. A shaft 40 mm diameter and 2.5 m long has a mass of 15 kg per meter length. It is simply supported at the ends and carries three masses 90 kg, 140 kg and 60 kg at 0.8 m, 1.5 m and 2 m respectively from the left support. Find the natural frequency of the transverse vibrations. Take $E = 200\ GN/m^2$.

7. A vibratory body of mass 150 kg supported on springs of total stiffness 1050 kN/m has a rotating unbalance force of 525 N at a speed of 6000 rpm. If the damping factor is 0.3 determine

   (a) the amplitude caused by the unbalance and its phase lag.

   (b) the transmissibility and

   (c) the actual force transmitted and its phase angle.

8. Explain the following:

   (a) Vibration isolation and transmissibility.

   (b) Free torsional vibration of geared systems.

[03 – 3113]

III/IV B.E. DEGREE EXAMINATION.

First Semester

Mechanical Engineering

THEORY OF MACHINES – II

(Common with Dual Degree Program in Mechanical Engineering)

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

Missing data if any may be assumed suitably.

1. Answer all questions.

   (a) Why is a cycloidal motion programme most suitable for high speed cams?

   (b) What do you mean by Differentials? Give example.

   (c) Define law of gearing.

   (d) What do you mean by force balancing of linkages? How is it achieved?

   (e) What are the methods to avoid interference?

   (f) What is magnification factor?

   (g) Explain energy method.

2. (a) Explain the gyroscopic effect of the Naval ships.

(b) The moment of inertia of an aeroplane air screw is 20 kg.m^2 and the speed of the rotation 1000 rpm clockwise when view from the front. The speed of the flight is 200 km per hour. Find the gyroscopic reaction of the air screw on the aeroplane when it makes a left handed turn on a path of 150 m radius.

3. A tangent cam with a base circle diameter of 50 mm operates a roller follower 20 mm in diameter. The line of stroke of the follower passes through the axis of the cam. The angle between the tangential faces of the cam is 60°, speed of the cam shaft 200 rpm and the lift of the follower 15 mm. Calculate

(a) the main dimensions of the cam

(b) the acceleration of the follower at

(i) The beginning of lift,

(ii) Where the roller just touches the nose,

(iii) The apex of the circular nose.

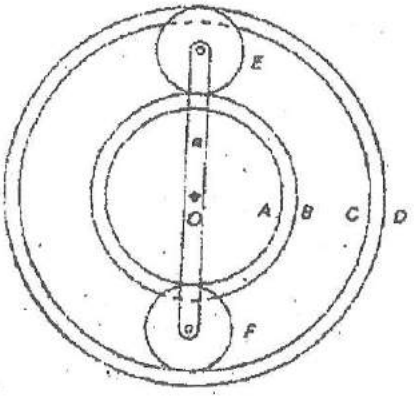
4. (a) Derive a relation for minimum number of teeth on the gearwheel and the pinion to avoid interference.

(b) Two right handed helical gears connect two shafts 70° apart. The larger gear has 50 teeth and the smaller 20. If the centre distance is 167 mm, determine the helix angle of the gears. The normal module is 4 mm.

5. In the epi-cyçlic gear train shown in figure below, the compound wheels A and B as well as internal wheels C and D rotate independently about the axis O. The wheels E and F rotate on the pins fixed to arm a. All the wheels are of the same module. The number of the teeth on the wheels are $T_A = 52$, $T_B = 56$, $T_E = T_F = 36$. Determine the speed of C if

(a) the wheel D fixed and arm a rotates at 200 rpm clockwise

(b) the wheel D rotates at 200 rpm counter-clockwise and the arm a rotates at 20 rpm counter clockwise.



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