Code: 9A03502

R9

B.Tech III Year I Semester (R09) Supplementary Examinations, May 2012

DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) What do you understand by gyroscopic couple? Derive a formula for its magnitude.

(b) The mass of the motor cycle along with the rider is 180 kg. The height of the centre of gravity of total mass is 60 cm above the ground when it moves straight. Each wheel has diameter equal to 70 cm and polar mass moment of inertia of each wheel is 2 kgm^2. The engine rotates at a speed 5 times the road wheel and engine rotating parts have polar mass moment of inertia equal to 0.2 kgm^2. Determine the angle of heel required if motor cycle negotiates a curve of radius 100 m at a speed of 108 km/hr.

2 (a) Explain the terms: friction circle and friction axis.

(b) Deduce an expression for the efficiency of an inclined plane when a body moves down a plane.

3 (a) Which of the two assumptions-uniform intensity of pressure or uniform rate of wear, would you make use of in designing friction clutch and why?

(b) A cone clutch with cone angle 20^0 is to transmit 7.5 kW at 750 r.p.m. The normal intensity of pressure between the contact faces is not to exceed 0.12 N/mm^2. The coefficient of friction is 0.2. If face width is $1/5^{th}$ of mean diameter, find:

(i) The main dimensions of the clutch, and

(ii) Axial force required while running.

4 (a) What is the function of flywheel? How does it differ from that of a governor?

(b) The torque delivered by a two-stroke engine is represented by T = (1000 + 300 sin 2ø - 500 cos 2ø) N.m where ø is the angle turned by the crank from the inner-dead centre. The engine speed is 250 rpm. The mass of the flywheel is 400 kg and radius of gyration 400 mm. Determine:

(i) The power developed.

(ii) The total percentage fluctuation of speed.

(iii) The angular acceleration of flywheel when the crank has rotated through an angle of 60^0 from the inner-dead centre.

(iv) The maximum angular acceleration and retardation of the flywheel.

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5 (a) What are centrifugal governors? How do they differ from inertia governors?
(b) The mass of each ball of a proell governor is 3 kg and the weight on the sleeve is 20 kg each arm is 220 mm long and the pivots of the upper and the lower arms are 20 mm form the axis. For the midposition of the sleeve the extension links of the lower arms are vertical, the height of the governor 180 mm and the speed 150 rpm. Determine the lengths of the extension links and the tension in the upper arms.

6 (a) Define and explain the term 'balancing of rotating masses' what will be the harm if the rotating parts of a high speed engine are not properly balanced?
(b) A shaft carries four rotating masses A, B, and C which are completely balanced. The masses B, C and D are 50 kg, 80kg and 70 kg respectively. The masses C and D make angles of 90^0 and 195^0 respectively with mass B in the same sense. The masses A, B, C and D are concentrated at radius 75 mm, 100 mm, 50 mm and 90 mm respectively. The plane of rotation of masses B and C are 250 mm apart. Determine:
(i) The mass A and its angular position.
(ii) The position of planes of A and D.

7 (a) Explain the term 'partial balancing of primary force'. Why is it necessary?
(b) A four cylinder vertical engine has cranks 300 mm long. The planes of rotation of the first, third and fourth cranks are 750, 1050 and 1650 mm respectively from that of the second crank and their reciprocating masses are 150, 400 and 250 kg respectively. Find the mass of the reciprocating parts for the second cylinder and the relative angular positions of the cranks in order that the engine may be in complete primary balance.

8 (a) What do you understand by 'Torsionally equivalent shaft'?
(b) Describe in detail the method of finding the frequency of torsional vibration of a two rotor system.

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