B. Tech. 5th Semester (Mechanical Engg.)
Examination,
December–2012
DYNAMICS OF MACHINES
Paper– ME-301-F

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt **five** questions in all, selecting at least **one** question from each section. **Q. No. 1 is compulsory**. All questions carry equal marks.*

1. (i) What is field balancing of rotors ? Explain the procedure.

(ii) Define and explain the superposition theorem as applicable to system of forces acting on a mechanism.

(iii) When and why is the correction couple applied while considering the inertia of the connecting rod of a reciprocating engine ?

(iv) Define the terms coefficient of fluctuation of energy and coefficient of fluctuation of speed.

(v) What is the difference between a brake and a clutch?

(vi) When and why is the correction couple applied while considering the inertia of the connecting rod of a reciprocating engine ?

(vii) In what way is the inertia of the connecting rod of a reciprocal engine taken into account ?

(viii) Define the terms coefficient of fluctuation of energy and coefficient of fluctuation of speed.

(ix) How is the friction at the bearings and at sliding pair of a mechanism is taken into account ?

(x) Why are the inertia governors quicker in action as compared to centrifugal governors ? Explain.

2×10

Section–A

2. The following data relate to a horizontal reciprocating engine :

Mass of reciprocating parts	= 120 kg
Crank length	= 90 mm
Engine speed	= 600 rpm
Connecting rod :	
Mass	= 90 kg

Length between centres = 450 mm

Distance of centre of mass from big end centre =180 mm

Radius of gyration about an axis through centre of mass =150 mm

Find the magnitude and the direction of the inertia torque on the crankshaft when the crank has turned 30° from the inner-dead centre. 20

3. (a) Determine the required input torque on the crank of a slider-crank mechanism for the static equilibrium when the applied piston load is 1500 N. The lengths of the crank and the connecting rod are 40 mm and 100 mm respectively and the crank has turned through 45° from the inner-dead centre.

(b) Describe the graphical method of considering the inertia of the connecting rod of a reciprocating engine. 10+10

Section–B

4. The following data refer to a two-cylinder uncoupled locomotive :

Rotating mass per cylinder = 280 kg

Reciprocating mass per cylinder = 300 kg

Distance between wheels	= 1400 mm
Distance between cylinder centres	= 600 mm
Diameter of treads of driving wheels	= 1800 mm
Crank radius	= 300 mm
Radius of centre of balance mass	= 620 mm
Locomotive speed	= 50 km/hr.
Angle between cylinder cranks	= 90°
Dead load on each wheel	= 3.5 tonne

Determine the

(i) balancing mass required in the planes of driving wheels if whole of the revolving and two-third of the reciprocating mass are to be balanced.

(ii) swaying couple

(iii) Variation in the tractive force

(iv) maximum and minimum pressure on the rails

(v) maximum speed of the locomotive without lifting the wheels from the rails. 20

5. (a) What is field balancing of rotors ? Explain the procedure.

(b) Describe the function of a pivoted-cradle balancing machine with the help of a neat sketch. So that it is possible to make only four test runs to obtain the balance masses in such a machine. 8+12

Section–C

6. In a proell governor the mass of each ball is 8 kg and the mass of the sleeve is 120 kg. Each arm is 180 mm long. The length of extension of lower arms to which the balls are attached is 80 mm. The distance of pivots of arms from axis of rotation is 30 mm and the radius of rotation of the balls is 160 mm when the arms are inclined at 40° to the axis of rotation. Determine the

(i) equilibrium speed

(ii) coefficient of insensitiveness if the friction of the mechanism is equivalent to 30 N

(iii) range of speed when the governor is inoperative.

20

7. (a) What is the advantage of a self-expanding shoe brake ? Derive the relation for the friction torque for such a brake.

(b) Write a short note on belt transmission Dynamometer. 10+10

Section–D

8. Each wheel of a four-wheeled rear engine automobile has a moment of inertia of 2.4 kg. m^2 and an effective diameter of 660 mm. The rotating parts of the engine have a moment of inertia of 1.2 kg. m^2. The engine axis is parallel to the back wheel is 3 to 1. The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The mass of the vehicle is 2200 kg and the centre of the mass is 550 mm above the road level. The track width of the vehicle is 1.5 m. Determine the limiting speed of the vehicle around a curve with 80 m radius so that all the four wheels maintain contact with the road surface.

20

9. (a) How do the effects of gyroscopic couple and of centrifugal force make the rider of a two-wheeler tilt on one side ? Derive a relation for the limiting speed of the vehicle.

(b) Discuss the gyroscopic effect on the vessels.

12+8