

R13

Code No: 115DY

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, March - 2017

DYNAMICS OF MACHINERY

(Common to AME, ME, MCT, MSNT)

Time: 3 hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A**(25 Marks)**

- 1.a) Explain the application of gyroscopic principles to aircrafts. [2]
- b) What will be the effect of the gyroscopic couple on a disc fixed at a certain angle to a rotating shaft? [3]
- c) Distinguish between brakes and dynamometers. [2]
- d) What is meant by the expression 'friction circle'? [3]
- e) Define the terms 'coefficient of fluctuation of energy' and 'coefficient of fluctuation of speed', in the case of flywheels. [2]
- f) What are the effects of friction and of adding a central weight to the sleeve of a Watt governor? [3]
- g) Distinguish primary and secondary balancing. [2]
- h) How do you balance V-engines? [3]
- i) Define free vibrations, forced vibrations and damped vibrations. [2]
- j) What do you understand by under damping, critical damping and over damping? [3]

PART - B**(50 Marks)**

2. A four-wheeled trolley car of total mass 2000 kg running on rails of 1.6 m gauge, rounds a curve of 30 m radius at 54 km/h. The track is banked at 8° . The wheels have an external diameter of 0.7 m and each pair with axle has a mass of 200 kg. The radius of gyration for each pair is 0.3 m. The height of centre of gravity of the car above the wheel base is 1 m. Determine, allowing for centrifugal force and gyroscopic couple actions, the pressure on each rail. [10]

OR

3. A rear engine automobile is travelling along a track of 100 metres mean radius. Each of the four road wheels has a moment of inertia of 2.5 kg-m^2 and an effective diameter of 0.6 m. The rotating parts of the engine have a moment of inertia of 1.2 kg-m^2 . The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The ratio of engine speed to back axle speed is 3 : 1. The automobile has a mass of 1600 kg and has its centre of gravity 0.5 m above road level. The width of the track of the vehicle is 1.5 m. Determine the limiting speed of the vehicle around the curve for all four wheels to maintain contact with the road surface. Assume that the road surface is not cambered and centre of gravity of the automobile lies centrally with respect to the four wheels. [10]

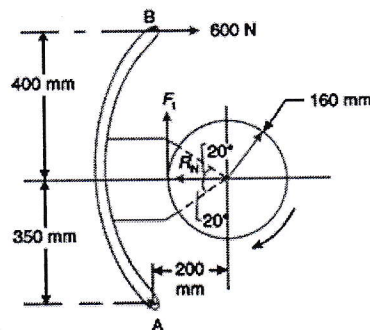
4. A rotor is driven by a co-axial motor through a single plate clutch, both sides of the plate being effective. The external and internal diameters of the plate are respectively 220 mm and 160 mm and the total spring load pressing the plates together is 570 N. The motor armature and shaft has a mass of 800 kg with an effective radius of gyration of 200 mm. The rotor has a mass of 1300 kg with an effective radius of gyration of 180 mm. The coefficient of friction for the clutch is 0.35. The driving motor is brought up to a speed of 1250 r.p.m. when the current is switched off and the clutch suddenly engaged. Determine

- The final speed of motor and rotor
- The time to reach this speed, and
- The kinetic energy lost during the period of slipping.

How long would slipping continue if it is assumed that a constant resisting torque of 60 N-m were present? If instead of a resisting torque, it is assumed that a constant driving torque of 60 N-m is maintained on the armature shaft, what would then be slipping time? [10]

OR

5. The below Figure shows a brake shoe applied to a drum by a lever AB which is pivoted at a fixed point A and rigidly fixed to the shoe. The radius of the drum is 160 mm. The coefficient of friction at the brake lining is 0.3. If the drum rotates clockwise, find the braking torque due to the horizontal force of 600 N at B. [10]



6. A certain machine requires a torque of $(1500 + 200 \sin \Theta)$ N.m to drive it, where Θ is the angle of rotation of the shaft. The machine is directly coupled to an engine which produces a torque of $(1500 + 200 \sin 2\Theta)$ N.m. The flywheel and the other rotating parts attached to the engine have a mass of 300 kg at a radius of gyration of 200 mm. If the mean speed is 200 rpm. Find (a) the fluctuation of energy (b) the total percentage fluctuation of speed (c) the maximum and the minimum angular acceleration of the flywheel and the corresponding shaft positions. [10]

OR

7. In an engine governor of the Porter type, the upper and lower arms are 200 mm and 250 mm respectively and pivoted on the axis of rotation. The mass of the central load is 15 kg, the mass of each ball is 2 kg and friction of the sleeve together with the resistance of the operating gear is equal to a load of 25 N at the sleeve. If the limiting inclinations of the upper arms to the vertical are 30° and 40° , find, taking friction into account, range of speed of the governor. [10]