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Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, May 2013
(2008 Scheme)
08.602 : DYNAMICS OF MACHINERY (MP)

Time : 3 Hours Max. Marks : 100

Instructions : 1) *Answer* ***all*** *questions from Part – **A**.*
2) *Answer* ***one*** *question each from* ***each*** *Module in Part – **B**.*

PART – A

1. With neat sketches explain the condition of static equilibrium of a member with
   a) three forces
   b) two force and a torque
2. With a neat sketch explain various forces considered in the dynamic force analysis of a reciprocating engine using Klein's construction.
3. Find the analytical solution for treating a continuous mass as a two mass equivalent dynamic system.
4. Find the equation for stability of an automobile for the following condition. Vehicle is moving forward, engine and wheels are rotating in the same direction and vehicle take a left turn. Consider weight of the vehicle, gyroscopic couple and centrifugal couple.
5. The rotor of a ship is rotating clockwise when viewed from rear end. Discuss the gyroscopic effect on the ship during
   a) steering b) pitching
6. Derive the equation for movement of sleeve of a Porter governor.

P.T.O.

7. Derive the equation to find the amplitude of steady state response in a force damped vibration.

8. Differentiate between viscous damping and coulomb damping.

9. Write short notes on

   a) Dunkerley's method

   b) Whirling of shafts.

10. Derive the equation for maximum variation of tractive force and maximum swaying couple of a locomotive. **(10×4=40 Marks)**

PART – B

Module – I

11. A vertical engine has the following data.

    Mass of reciprocating parts = 10 kg, Stroke length = 200 mm, Mass of connecting rod = 14 kg, Length of connecting rod = 500 mm, Engine speed = 250 rpm, Distance between centre of gravity of connecting rod and big end of the bearing = 200 mm, Frictional resistance at the reciprocating part = 25 N. Find the torque on the crank shaft, when the crank has turned 60° and piston moves down.

OR

12. A machine has to carry out punching operations at the rate of 10 holes per minute. It does 6 kN.m of work per mm^2 of the sheared area in cutting 25 mm diameter holes in 20 mm thick plates. A flywheel is fitted to the machine shaft which is driven by constant torque. The fluctuation of the speed is between 180 and 200 rpm. The actual punching operation takes 2s. The frictional losses are equivalent to $1/6^{th}$ of the work done during punching. Find

    a) power required to drive the punching machine, and

    b) mass of flywheel, if the radius of gyration of the flywheel is 0.5 m.

Module – II

13. A Proell governor has sleeve weight 175 N, arms 300 mm long and weight of each ball 10 N. The arms are pivoted at a distance of 50 mm from the axis of rotation. The extension of the lower arm to which each ball attached is 125 mm long and radius of rotation of the ball is 250 mm. When the arms are inclined 35° to the axis of rotation, find

    a) equilibrium speed for the above configuration and

    b) range of speed for which the governor is insensitive, if the friction of the governor is 7 N.

OR

14. The two outer cranks of a four cylinder inline engine are set at 125° to each other and their reciprocating masses are 450 kg. For the adjacent cranks, the distance between the planes of rotation is 400 mm, 700 mm and 600 mm respectively. If complete primary balancing of the engine is to be done, find out the magnitude of reciprocating masses and their relative angular positions for each of the inner cranks. Also find out the secondary unbalanced force, if length of each crank is 350 mm, length of each connecting rod is 1200 mm and the speed of rotation is 250 rpm.

Module – III

15. A harmonic exciting force of 40 N acts on a body creating resonant amplitude of 20 mm at a period of 0.3 second. The body which is vibrating in a viscous medium has a mass of 3 kg. Find the damping coefficient. If the damper is removed and the exciting force frequency changed to 5 Hz, find out the increasing amplitude of forced vibrations.

OR

16. Three rotors A, B, C having moment of inertia of 2500, 6000 and 3000 kg.m^2 respectively are carried on a uniform shaft of 0.35 m diameter. The length of shaft between rotor A and B is 6 m and between B and C is 30 m. Find the natural frequency of torsional vibrations. The modulus of rigidity of the shaft material is 80 GN/m^2. **(3×20=60 Marks)**